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ECONOMIC GEOGRAPHY

APRIL

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L. LeMar Stephan

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LAND UTILIZATION IN THE MIDDLE GRAND RIVER VALLEY OF WESTERN ONTARIO

Chun-fen Lee

LARK UNIVERSITY, WORCESTER, MASSACHUSETTS, U.S.A.

OUR CONTRIBUTORS

Professor Stephan, State Teachers College, Troy, Alabama, has written several articles for ECONOMIC GEOGRAPHY.

President Atwood of Clark University, Worcester, is the editor of ECONOMIC GEOGRAPHY.

Dr. Stratton, Assistant Professor of History and Government at Denison University, received his doctorate from the University of Pennsylvania in 1942.

Dr. Lee received his doctorate from the University of Toronto where he studied from 1940 to 1943. The present article is part of his dissertation.

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THE EVERGLADES

LONG one of the wildernesses of America, sanctuary for wild fowl, predator mammals, hunted men, and persecuted aborigines, the Everglades are being reclaimed for man's use—for hunting and fishing, for agriculture, and for recreation and entertainment. Bear and deer that frequented their hammocks and their thicket fastnesses, alligators and snakes that infested their every stream and trail, hosts of birds that found nesting haunts in their moss-grown cypresses and feeding grounds in their mangrove-rooted pools have been pushed back farther and farther away from the ways of men, his avenues of movement.

Where once saw-grass waved above the level glades, and custard-apple bent and broke before the lashing fury of tropical cyclones that swept across the land, grow thriving crops of muck-planted celery and lettuce, beans and peas, spinach and cabbage for northern markets wrapped in winter snows, and vast fields of sugar-cane from which to press thousands of tons of high quality syrup. Great stretches of the Everglades have been transformed into fruitful gardens and productive crop lands. They have become important and essential elements in the dietary and economy of a strong and active people, contributing vitamins and food elements that their sunshine and fertility have produced in such lavish store.

The Everglades, once the synonym for inhospitable and repulsive wilderness, shelter of sullen aborigines reluctant to come under the yoke of civilization, refuge of renegades who would escape the mandates of law and the tenets of order and justice, have now become the symbol for success in reclaiming waste places of the earth for man's welfare and comfort, and making of them a place for cultivation of fruit and flowers, of staple foods and specialized luxuries.

ECONOMIC GEOGRAPHY

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VEGETABLE PRODUCTION IN THE NORTHERN EVERGLADES

L. LeMar Stephan

FRESH winter-grown vegetables at moderate prices are relatively recent. Use of refrigerated cars and trucks (especially since 1900) has resulted, in part, in the present intensive winter utilization of land for vetegables in California, Rio Grande valley, other western irrigated districts, Florida, and southern coastal districts. At the same time, it was necessary to develop regions which could grow commercial vegetables in winter, and it is worth noting that several thousand carloads of vegetables are imported from nearby off-shore islands and Mexico. Finally, new methods of packing and precooling and new channels for marketing had to be worked out, including adequate market terminals.

Now that a high per cent of canned goods and dehydrated vegetables are going to our armed forces and to lend-lease, many thousands of northern urban families are even more dependent than ever, upon fresh winter vegetables as an important adjunct to their diet supplying to them vitamins and essential minerals.

One of the major winter-truck farming areas in eastern United States forms a crescent around southern Lake Okeechobee (Figure 1), in the northern Everglades. Palm Beach County produced 29.4 per cent (by value) of Florida's vegetables in 1939. Statistics for 1940–41 season show that approximately 13,400 carloads of vegetables were mostly produced in the northern Everglades section of Palm Beach county, including 5,500 carloads of beans, 2,000 carloads of cabbage, 1,800 carloads of tomatoes, and 1,500 carloads of celery. Figures for truck loads are not available; from one-fourth to one-third of the vegetables marketed probably move by truck. Several hundred cars seasonally leave a portion of Glades and Hendry counties adjacent to southwest Lake Okeechobee.

THE SEASONAL ROUND IN FARM ORGANIZATION

Organization of truck farming throughout the year is based upon demand of northern markets and upon the seasonality of Everglades climate. The seasonal farm operations, as shown in (Table I), are divided into land preparation, planting, and harvesting dates for the major vegetables grown in the Glades. In summer, northern-grown vegetables monopolize markets, hence there is little activity in the Everglades during the hot, rainy season. In contrast, the cool dry season is a period of intensive work.

Summer.—The humid summers coincide with a period of little activity, extending approximately from last part of May to mid-September. High temperatures, averaging 80 degrees F., during these four months would produce inferior leafy vegetables and frequent heavy showers would inaugurate periodic flooded conditions. Pumping of excess water would be prohibitively expensive. Operation of machines would be difficult in soggy fields. Insect life is at a maximum.

Until the last of May tomatoes are still being picked and another minor crop, sweet corn, is harvested. In order to maintain soil fertility, in May and June, some farmers plant cover crops such as soya beans, cowpeas, velvet beans, and Sesbania. Meanwhile farmers are repairing and cleaning ditches, mending pumps, repairing muck lanes and bridges, overhauling machinery, and constructing mole drains. But by June, for the most part, a landscape which is deplete of crops, devoid of pickers, and deeply covered by a dense weed growth is characteristic. Common names of some of the "invasion" weeds are pig weed, Para grass, castor beans, broom sedge, crab grass, and crow foot. The prevailing color is generally a dull green. The territory looks much as if it had never been cultivated, so high and dense is the rapid spread of weeds (Figure 2). By mid-July some farmer start "running down" their fields, that is, mashing and cutting weed growths, then they mow with a machine called a "devil-catcher" or grass cutter. Stems are plowed under. This process is repeated once or twice more before fall planting. Commercial fertilizers are applied to soil before fall planting. Plowing for planting is begun around August 1. The few farmers who have wisely grown summer cover crops now turn them under as green manure. Dry field corn is harvested in August. Celery beds are prepared about the same time. Fields, devoid of weeds during the last of summer, take on a

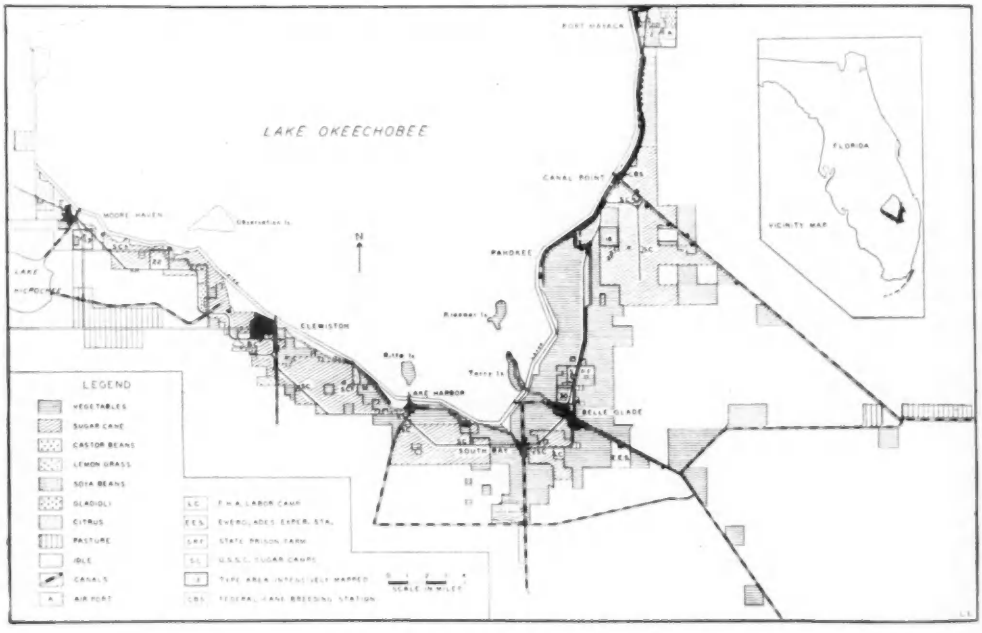

FIGURE 1.—Land utilization of the Upper Glades, 1940.

TABLE I

SEASONAL OPERATIONS ON VEGETABLE FARMS

Work	*July*	*August*	*September*	*October*	*November*	*December*	*January*	*February*	*March*	*April*	*May*	*June*
Land preparation:												
Cutting	***	**********	******									
Mashing												
Disking												
Plowing												
Planting:												
1. Snap beans			*****	********	**********	**********	**********	**********	****			
2. English peas		(seed beds)		****	**********	**********						
3. Celery		**********	**********	********	**********	**********	**********					
4. Cabbage				********	**********	**********						
5. Potatoes			******	********	**********	**********	**********	*****				
6. Lima Beans				********	**********	**********	**********					
							(seed beds)					
7. Tomatoes						*	**********	**********	******			
8. Cover crops											*****	*****
Harvesting:												
1. Snap beans					**********	**********	**********	**********	*******	*******		
2. English peas						*****	**********	**********				
3. Celery							**********	**********	*******	*******		
4. Cabbage							**********	**********	*******			
5. Potatoes						**	**********	**********	**********	*******	****	
6. Lima Beans						**	**********	**********	**********	*******	*******	
7. Tomatoes										*******	******	

new color, black. A square mile mapped near Belle Glade in August (Figure 3) shows the land as practically idle (Figure 1 indicates location on the southeast side of the lake). No cover crops were in evidence. Field corn occupied one-fourth of the section.

Fall.—Autumn ushers in a period of real farm work, beginning about September 15 and lasting through December 20, when fall planting activities are superseded by harvesting. Heavy rains may delay land preparation and planting, as this is the hurricane season, but early planting of snap beans, potatoes, and celery seed beds is desirable in order to avoid damage from early winter frosts in November and December (Figure 16), and to capture an early fall northern market in competition with other producing areas. In fields, streaks of black dust follow tractors, diskers, fertilizers, planters, drag cultivators, and sprayers. A high degree of mechanization reflects the presence of level land and fertile soils.

Much field labor is needed for harvesting the chief fall crop, snap beans, and the secondary commercial vegetables: lima beans, escarole, peppers, egg plant, and onions. Soon after the planting a light green color pervades the landscape. An influx of several thousand migrants, chiefly Negroes, begins around October 15. Other people arrive: truckers, commission men, buyers, townspeople, and packing-house girls. As numerous trucks and automobiles crowd the lake shore highway and field muck lanes loaded with both Negroes and produce, as rail cars by the dozen stand beside packing houses awaiting shipment, as hundreds of pickers cluster in fields, as airplanes hover low over bean tracts to spray and dust, the busyness of the autumn agricultural scene is evident.

The same section mapped near Belle Glade was remapped in November (Figure 5). In striking contrast to the summer scene, there was a complete land cover. Green snap beans predominated. Corn windbreaks commonly set off each six to twelve rows of beans. One-room unpainted Negroes' shacks

and a few houses for whites are situated near roads, canals and section lines. The buildings of a small Negro settlement are clustered compactly along the railroad and road. There is a close rectangular network of farm ditches, lateral canals, and muck lanes.

Winter.—In winter heavy production of celery, cabbage, and English peas differs from the autumn emphasis on beans. This season lasts about two and one-half months (December 20 to March 1). Harvesting of peas begins about the middle of December. By this time the temperatures average from 62 to 65 degrees F. and rains have abated to an approximate one to two inches per month. (Figure 16). Soils have become drier and the water table has been lowered. Danger from frost now is imminent. About mid-December over 2,000 Negroes leave the Glades for the east coast to harvest beans and tomatoes for two or three months. Sufficient numbers remain, however, to satisfy the Everglades harvest during the mid-winter slack. A sharp decrease in vegetable shipments for February is attributable to the usual frost damage. Meanwhile, beans, potatoes, and sundry minor vegetables continue to be picked. The hardier cabbage and celery are ready for market about the first of January. Beans and other vegetables are continuously being planted for spring sale. Tomato plants are set in fields, by hand, about the first of February. Winter farming calls for somewhat less activity than that of autumn and spring. Planted fields are interspersed with temporarily-idle ones, thus they appear from the air as huge patchwork quilts in colors of black and light green. The three islands of southern Lake Okeechobee, Torry, Ritta, and Kreamer, show a similar landscape and farm pattern.

FIGURE 2.—Heavy weed growth in summer characterizes the landscape around Lake Okeechobee. (Courtesy of Everglades Experiment Station.)

A section representative of winter land use was mapped in the Pelican Lake district one and one-half miles east of Pahokee (Figure 7). Beans either had been or were being picked and English peas were being planted or were already up. Celery was absent in this particular section. Complete utilization is again conspicuous here.

Spring.—The spring months of March, April, and the first-half of May attain a second peak in vegetable production. Snap beans, tomatoes, and celery comprise the main vegetables. The harvest of cabbage continues. Commercial truck plantings cease about the middle of March. By February, soils are dry enough for planting tomatoes on Okeelanta peaty muck and Everglades peat. Okeechobee muck, adjacent to Lake Okeechobee, is too dry. The dangers of spring rains, late frosts, insects, drouths,

and competition from other regions vary from year to year. Many Negroes, who left the Glades in December for the Florida east coast harvest, return to normally fill the requirements of the peak labor demand of the year in March and April. Spring is a busy season for agriculturalists. Farmers who have failed to obtain satisfactory returns from fall and winter crops will stake much on the hope of spring success. In May, harvest requirements dwindle, transient laborers leave, carlot shipments decrease, packing houses close, and towns appear half-abandoned. As temperatures and humidity soar and rainfall increases, many owners and managers of farms with their families leave their homes and another inactive agricultural season begins.

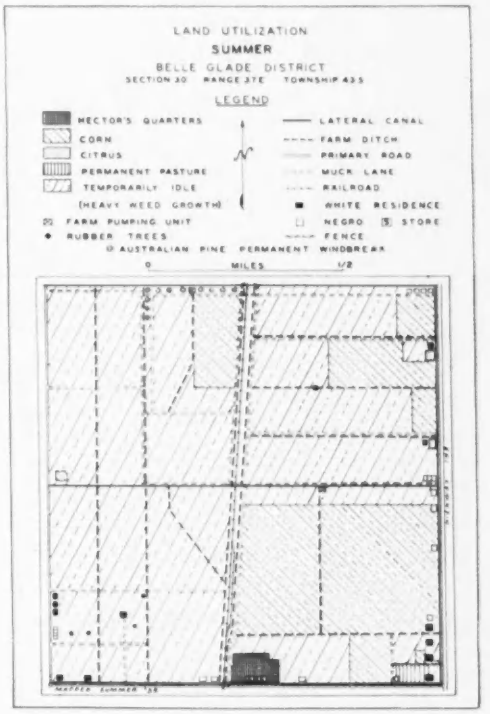

FIGURE 3.—Very little land use and activity are associated with hot and humid summers, nevertheless, there are adaptable crops which could yield well and with much profit on this tract of Okeechobee muck.

EARLY VEGETABLE FARMING AND LAND TENURE

Probably as early as 1900 there were a few patches of vegetables in clearings in the densely-wooded custard apple forest belt facing Lake Okeechobee. Settlement proceeded slowly and fishing remained the dominant activity until 1915. Some men divided their time between fishing and farming. Meanwhile, several land-development companies sold small tracts, chiefly to people living in the mid-western and southern states. A customary inducement was the inclusion of a "town" lot to each buyer. Several isolated "towns," such as Okeelanta and Fruitcrest, developed feebly. Land prices averaged about $1.25 an acre in 1908 and $15.00 in 1910. Sale of land followed the effort of Governor N. B. Broward to reclaim the Everglades, as agreed by Florida in accepting the land from the Federal government. When buyers arrived to inspect their property some left, disappointed in their rather inaccessible and perhaps still-flooded tracts of land, while others remained to farm the lake shore near migratory fishing camps. Communication with the east coast was via canal for approximately five years, but by 1919 two railroads had reached the Upper Glades, and by the middle twenties vegetable traffic by water had virtually ceased. The principal vegetables which were grown here, in limited acreage, were Irish potatoes, green corn, dasheen, string beans, lima beans, peppers, egg plant, and tomatoes. Packing facilities were absent and there was no Negro labor available until after World War I.

Land speculation and *Raubwirtschaft* were both rampant until some ten years ago. "Suitcase" farmers would grow a crop, then return north in the summer, "Wildcat" operators, until recently, went from rented farm to rented farm

abusing soils. "Squatters" formerly lived in towns or on their illegally-gained land and farmed small acreages belonging to the state, drainage district, or land companies. The prevalence of tenant-operated lands (in 1939 nearly 75 per cent of the lake region) introduces well-known problems associated with absentee-ownership. In addition there is at present need for more careful drainage on these rented tracts. Within the last few years there have been two changes in land tenure: First, tenancy has shifted from a share to a cash basis, landowners preferring assured return from cash rental rather than speculative return derived from share rentals. A second change in land policy, begun in 1938, is the appreciable increase in land ownership. Farm land in Palm Beach county expanded 131.9 per cent from 1930 to 1940 while the amount of farmland owned by the operator increased 240.8 per cent. Reasons for this shift were the clearance of land titles by the Murphy Act of 1937 and the 1941 tax-compromise plan. The refunding loan of the R. F. C. has encouraged landowners to improve their farms. The present war has affected production favorably and has increased total acreage under cultivation. The size of land holdings has also increased. Many men farm a section, several operate tracts of 1,000 acres or more, but there are still many owner-operated tracts of from 10 to 40 acres (Figure 18).

NATURE OF THE PHYSICAL ENVIRONMENT

In addition to economic problems, chief of which has been variation in market prices, vegetable production has also been affected by certain physical features peculiar to the Everglades.

Location and space.—By virtue of its low latitude, low altitude, and vicinal location near warm waters surrounding peninsular south Florida, the Everglades climate partakes largely of the attributes found within and associated with the prevailing mT air mass. Since only in winter may this situation occasionally be changed, the Everglades climate is sub-tropical. On the other hand, the Everglades, from the point of view of the truck farmer, is in some respects too far south from the centers of population. Although the grower has a choice between truck, rail, and water transportation, he must take extra-ordinary precautions in order to get his produce to market in saleable condition.

Mere space is plentiful, but this land has negative value, economically, until it has been made accessible and drained. It is estimated that some 500,000 acres of sawgrass could profitably be cultivated.

Terrain.—Occupying most of southern Florida is a vast marsh, comprising approximately 4,000 square miles. The Everglades narrowly rim the northern shore of Lake Okeechobee and widen southward to some 40 to 50 miles in the vicinity of Cape Sable, where the fresh water of the Glades merges imperceptibly into salt water flats.

The physiographic setting of the Everglades resembles that of the Okefinokee and Dismal swamps. All three represent outer coastal plain marshes of the upland variety, developed upon inter-

FIGURE 4.—Weeds have been "run down." Tractors are employed to further prepare the land for autumn planting of vegetables.

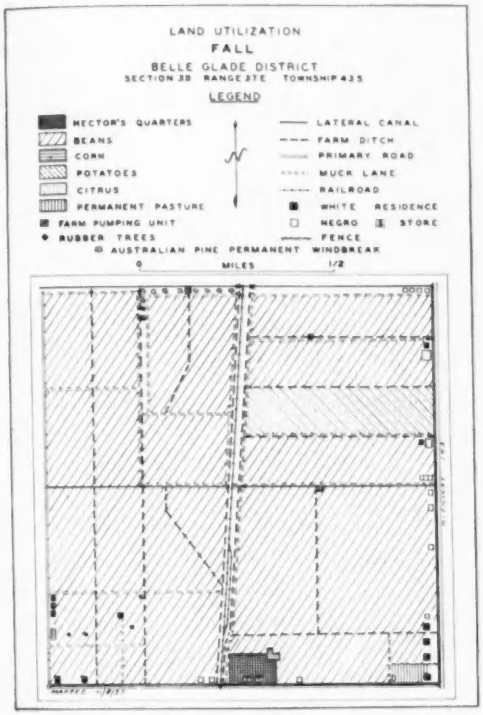

FIGURE 5.—The rectangular pattern of cultural features is in response to both the flat terrain and numerous drainage ditches. Underground mole drains placed between farm ditches do not show. Fall emphasis upon snap beans shows statistically as well as on the type area mapped.

fluves in an extremely youthful emerged plain. Drainage is weakly developed and sheets of water may be seen between muddy sloughs. Occasional "domes" of cypress or hammocks of willow, myrtle and bay trees break the monotony of the prevailing expanse of sawgrass (*Cladium effusium*) in the Everglades. Some "elevated" hammocks form village and camp sites for Seminoles. The flat terrain facilitates and encourages modern mechanization of agriculture.

Structure.—Sediments, such as sand, gravel, and clay cover the old core rocks of the submerged Floridian Plateau. Lime precipitated from sea water, especially during Eocene and Oligocene time, now forms the limestone "backbone" of Florida, consequent upon uplift and arching. The basal formation of the Everglades is Caloosahatchee marl, consisting of fine sand and Pliocene shells (Figure 10). Thin deposits of Pleistocene lime and marl (Ft. Thompson) rest unconformably upon the Caloosahatchee formation. Miami oolite (Pleistocene), considerably more porous than the Ft. Thompson deposits, underlies a portion of the northeastern Everglades. The muck and peat soils, overlying the Ft. Thompson and Miami oolite formations, have developed and accumulated from plant remains rich in lime content.

Soils.—In contrast with the acid properties characteristically associated with peat beds, the rather high alkalinity of the Everglades solum (5.5 per cent to 5.8 per cent) promotes successful crop yields. Different soil properties and profile characteristics make for a three-fold soil division about southern Lake Okeechobee. The names "Muck," "Peaty Muck," and "Brown Fibrous Peat" were originated by Baldwin and Hawker in 1915 for the U. S. Soil Survey (Figure 11). However, the local names "custard apple," "willow and elder," and "sawgrass peat" are a more common designation. The Allison and Dachnowski-Stokes soil survey of 1929 classified the soils as Okeechobee series, Okeelanta series, and Loxahatchee series, respectively.

Forming a crescent about the south shore of Lake Okeechobee is a heavy black organic soil, Okeechobee muck (Figure 13), which forms the choice vegetable farm lands; here higher land values indicate greater soil fertility and more reliable frost protection. This area under intensive cultivation, comprising some 25,000 acres, includes several sections of cane-sugar. Today only a few virgin trees remain of the original dense growth of custard apple (Annona glabra), intermingled with

cypress, fig, and other tropical plants, all overgrown and interwoven with lianes. Epiphytes grew above the forest floor, which was mantled with ferns. Extending into the lake succulent water plants grew abundantly. Mineral constituents of the soil as potassium, phosphorus, magnesium, oxides of iron and aluminum, were deposited by the former annual "spilling over" of the lake. About 50 per cent of dry weight of Okeechobee muck is ash or mineral after burning, which contrasts with about 10 per cent ash content for Everglades sawgrass peat. The "very deep" phase of this plastic muck (i.e. over eight feet) adjoins the southeast shore.

Formerly a transition zone of shrubs about three quarters of a mile in width grew on the Everglades' side of the custard apple belt. Willow (Salix longipes) and elder (Sambucus intermedia Carr) were dominant. Species of pigweed and foxtail, Para, and other grasses had invaded the sawgrass (Cladium effusium). The Okeelanta peaty muck represents a transition stage between the two more diverse and distinct soil types disposed on either side. Characteristics of the profile are shown in Table II. In the present farm pattern of the Upper Glades both vegetables and cane yield well on this soil, however, its position gives less frost protection from nearby lake waters than is found on Okeechobee muck. By contrast with Everglades peat, Okeelanta peaty muck contains higher quantities of silica, iron, aluminum, potash, and sulfur and lower amounts of organic matter and nitrogen.

It is significant to compare the profiles of the three soil types, as seen in Table 2. Underlying each soil type is the brown fibrous peat derived largely from sawgrass. The sedimentary material decreases and the sawgrass components increase in the profiles, from the lake gladesward. Mean elevations, soil depth and soil fertility fall progressively lower along the same trajectory.

Everglades peat occupies most of the broad and flat sawgrass plain that constitutes the Everglades. Sawgrass, a sedge, dominates the flora of this treeless prairie, attaining heights varying from four to eight feet. *Cladium* sp. is associated with other herbaceous plants such as arrow arum, arrowhead, water lilies, pickerel weeds, and a few ferns. The upper horizon, six to 18 inches, consists of black, finely-fibrous organic material containing from eight to 15 per cent mineral matter. Underlying this material is brown fibrous raw peat which rests on either limestone or sand, which are found at varying depths. Light applications of certain trace elements such as copper, manganese, and zinc and heavy additions of phosphate and potash are necessary for commercial farming. Oxidation and compaction (which cause subsidence) and frequent burning are particularly critical on Everglades peat areas. Although only moderately fertile, it is associated with high productivity of both vegetables and cane-sugar. This soil is not as choice land for winter-grown vegetables as Okeechobee muck because it has less frost protection, drainage operations are more expensive, and heavier fertilizer applications are required.

Climate.—The climate of the northern Everglades, representing Koppen's Aw' type, is characterized by transitional qualities of continental and marine-tropical origin. Tropical air masses dominate the weather; other controls are low latitude and high sun, pressure systems and peninsular location with surrounding warm waters.

Seasonality of both temperature and rainfall is well developed and land use practises have been adjusted to this seasonality. Upper Glades summers

TABLE II

SOME PHYSICAL AND CHEMICAL CHARACTERISTICS OF THREE IMPORTANT EVERGLADES SOIL TYPES

Soil Type		*Depth*	*Character of Organic Material*	*Ash Content (%)*[4]	*CaO Plus MgO (%)*[5]	*N (%)*[5]	*P_2O_5 (%)*[5]	*K_2O (%)*[5]	*pH*	*Volume Weight (Lbs. per Cu. Ft.)*[6]
Okeechobee Muck[1]	1	0″– 9″	Black, granular to moist, plastic muck	64.35	2.342	1.51	0.22	0.249	5.80	—[7]
	2	9″–13″	Similar to No. 1, containing some fibrous peat	50.31	2.885	1.85	0.15	0.294	5.46	—
	3	13″–26″	Dense, black, plastic muck	63.07	2.713	1.63	0.10	0.384	5.83	19.17
	4	26″–33″	Brown, fibrous, sawgrass peat	8.76	3.264	3.44	0.08	0.100	5.83	9.38
	5	33″–58″	Sawgrass peat with black, slightly plastic matrix	17.03	5.477	2.84	0.08	0.100	6.22	12.83
	6	58″–72″	Generally similar to but more fibrous than No. 5	9.11	4.816	2.95	0.05	0.114	6.39	—[8]
	7	72″–77″	Yellow, very fibrous, sawgrass peat	8.46	4.448	3.18	0.04	0.143	6.64	—
	8	77″–94″	Sawgrass peat with black, slightly plastic matrix	19.05	5.331	2.82	0.05	0.106	6.98	—
	9	94″–104″	Black, plastic muck mixed with fibrous peat and sand; some marl pockets at interface with rock	81.27	1.917	0.79	0.05	0.220	7.83	—
Okeelanta Peaty Muck[2]	1	0″– 6″	Brown, fibrous peat, fairly well decomposed	38.38	3.322	2.22	0.24	0.234	5.97	16.52
	2	6″–14″	Very dense, yellow, fibrous sawgrass peat	8.34	4.360	3.46	0.10	0.096	6.05	8.13
	3	14″–19″	Black, plastic muck with considerable fiber	44.71	2.803	2.31	0.13	0.052	5.97	16.12
	4	19″–23″	Brown, fibrous sawgrass peat	28.31	3.998	2.86	0.11	0.234	5.97	11.89
	5	23″–36″	Black, plastic muck	64.59	3.155	1.32	0.07	0.360	6.14	20.13
	6	36″–66″	Dark brown, fibrous sawgrass peat	10.79	5.233	2.67	0.04	0.124	5.88	8.82
	7	66″–69″	Yellow, very fibrous sawgrass peat	7.42	3.998	3.03	0.04	0.081	6.25	—[8]
	8	69″–77″	Dark brown, fibrous sawgrass peat	12.48	5.151	3.18	0.05	0.172	6.81	—
	9	77″–82″	Yellow, very fibrous peat with some black, plastic matrix at interface with rock	13.32	4.435	3.41	0.04	0.100	6.93	—
Everglades Peat[3]	1	0″– 5″	Brown, fibrous sawgrass peat	12.01	5.529	3.84	0.22	0.135	6.47	7.32
	2	5″–15″	Yellowish-brown, coarsely fibrous, sawgrass peat	7.10	5.907	3.15	0.09	0.108	6.39	6.42
	3	15″–29″	Dark brown finely fibrous sawgrass peat	7.77	6.332	3.04	0.06	0.094	6.47	6.84
	4	29″–34″	Dark brown, sawgrass peat with slightly plastic matrix	9.44	7.006	3.07	0.06	0.120	6.39	8.05
	5	34″–51″	Brown, coarsely fibrous, sawgrass peat	7.52	5.821	2.73	0.08	0.116	6.56	5.55
	6	51″–58″	Yellowish-brown, coarsely fibrous, sawgrass peat	6.44	4.973	2.97	0.10	0.124	6.81	—[8]
	7	58″–66″	Brown, coarsely fibrous, sawgrass peat	9.43	4.057	3.53	0.04	0.114	6.98	—
	8	66″–70″	Coarsely fibrous, matted, sawgrass peat with some sand; marl pockets at interface with rock	32.09	5.963	2.85	0.07	0.153	7.49	—

[1] Profile (No. 197) taken from N.W. ¼ Section 14, West of South Bay, April, 1929.
[2] Profile (No. 202) taken from center of south line of Section 5, South of Belle Glade, April, 1929.
[3] Profile (No. 204) taken from position 300 feet West of North New River Canal and 15 miles South of South Bay, May, 1929.
[4] Calculated as loss on ignition, oven dry basis.
[5] Calculated on oven dry basis.
[6] Calculated basis field volume of soil, oven dried.
[7] Too dry for accurate sampling.
[8] At or below water table.

are wet (40.66 inches), whereas only 12.81 inches normally falls in winter (Figure 16). Summer temperatures of 80.2 degrees F. contrast with mild winters averaging 65 degrees F. Cool winter temperatures favor truck farming, as well as growth of cane-sugar and pasturing of beef cattle. In addition, the prevailing easterlies, uninterrupted over the prairie, provide for bodily relief from heat of long summers associated with high humidity.

Seasonal attendance of both cold waves and hurricanes, two unfortunate climatic aspects, is aided by both low elevation and flat terrain. Southward invasions of modified cP air cause vegetable and cane yields to fluctuate,

cane suffering less often than tender vegetables. Normally there is a steep winter temperature and pressure gradient over eastern United States extending as far south as Tampa. Winter storm tracks progress outward (easterly via south) between the North American high and Azores high. Occasional merging of the weaker Azores high with the continental high accentuates the normal steep barometric slope thus providing possibilities for far southward surges of cP air. As a result, cold waves may prevail in extreme south Florida, damaging truck especially during clear nights when marked temperature inversions result from high pressure with low barometric slope. It has been computed that 17 per cent of all frosts appear from November 5 to December 15, 67 per cent from December 15 to March 1, and 16 per cent from March 1 to April 29 (G. R. Townsend, Plant Pathologist at the Everglades Experiment Station). Each winter season, however, some vegetable fields are frozen: there may be a 10 per cent, a 50 per cent, a 30 per cent damage by areal extent. Temperatures vary locally here too. Vegetables growing on the fertile crescent of Okeechobee muck usually are protected by warm lake currents of air. Water seepage through porous soil horizons tends to prevent excessive freezes. Airplanes have been employed by some growers to stir up air by flying at very low levels above truck fields. Heaters are not used. Hurricanes may still cause wind damage, but, it is hoped, the levee completed in 1937 will control flooding.

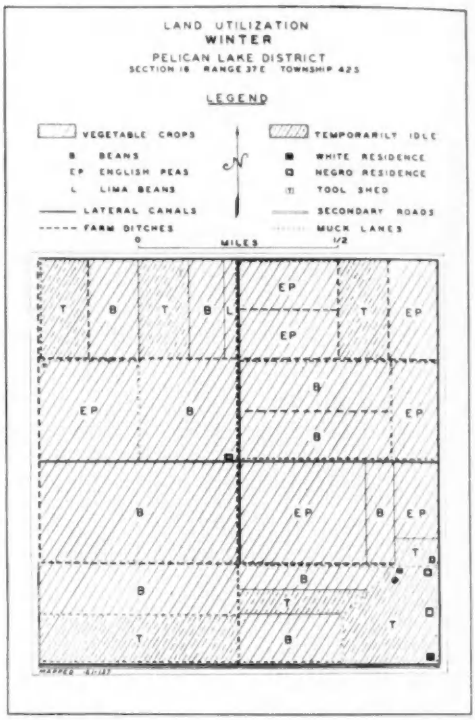

FIGURE 7.—Fields of beans represent the fall crop, English peas the winter crop and temporarily idle plots have been harvested. Section 16 is near Pahokee (see Figure 1) on Okeechobee muck.

FIGURE 6.—View of one of the first tractors in the Glades, mired (1924). (Courtesy of John Newhouse, Belle Glade.)

A third unfavorable aspect of the Glades climate pertains to fluctuation in rainfall. At Canal Point, for example, total rainfall for the period January 1 to March 15 varied as follows: 1934—6.1 inches; 1935—3.1 inches; 1936—10.2 inches; 1937—6.25 inches; 1938—0.96 inches. All seasons show this same divergence from the normal. During a drouth in late 1937 and early 1938, jassids proved detrimental to bean and pea yields, cattle ponds disappeared, sawgrass shriveled, vegetable shipments declined, and muck fires were rampant.

Periods of heavy rainfall also greatly hamper winter-season truck.

Although the Everglades has a climate favorable for winter-produced vegetables, the hazard of cold waves, hurricanes and rainfall uncertainties are encouraging greater emphasis upon cane-sugar, cattle production, and general diversification of farming.

Water Control.—When man first saw the rich black soil of the Everglades, in that land having year-round growing conditions, it seemed that all he must do was to remove surface water that stood during the rainy season before he could begin farming. The standing water came in part from heavy rainfall, but more from overflow of Lake Okeechobee over its low south bank. Drainage of the whole area was prevented by a sand and limestone embankment rimming south Florida. The Everglades Drainage District (created by act of the Florida legislature) began in 1906 to dredge a series of canals from the south shore of the lake southeastward to the Atlantic, in the hope that the entire Everglades could be reclaimed by thus lowering the level of the lake and providing outlets whereby surface water could reach the ocean.

By 1913 it was evident that the long diagonal canals did not have steep enough grade to aid appreciably in lowering the level of the lake. A "control" canal was proposed to connect lake and ocean at the shortest practicable point. Accordingly, construction of the St. Lucie canal was undertaken in 1916 and completed in 1926. It is now possible to control the lake level with reasonable accuracy. The first control levels of Lake Okeechobee were 16 to 19 feet; soil subsidence of approximately four feet has led to new levels ranging from 14 to 17 feet. The resident Associate Drainage Engineer of the Bureau of Agricultural Engineering believes 16 feet to be the most satisfactory level. High levels are of value in fire prevention, irrigation, waterway transportation, wild life conservation, and frost control, but low levels are desired by owners of land on islands or in the three lowest drainage districts, and by east coast tourist areas, which object to discharge of water that is great enough to disturb coastal fishing.

More serious than crop damage from an overflowing of Lake Okeechobee was the hurricane peril that was forced on the attention of Everglades settlers in 1926 and again in 1928. The muck, marl, and sand levee, begun in 1921 to restore the natural lake rim lowered by soil subsidence, was not high enough to confine wave crests of 29 feet and some breaching of the levee resulted. Heavy loss of life in these two hurricanes led the Federal government, for the protection of human life and for the maintenance of navigation, to join with local interests in constructing a 34-feet high, 66-mile dike around the southern half of the lake. Today elaborate precautions are taken each hurricane season.

Conditions in the Glades favor the individual who has large capital resources. For the man lacking ample capital two alternatives deserve consideration: a development of coöperatives and resurrection of the idea of subsistence farms, which was so strong in the first years of Glades occupance. Although subsistence farming formerly was unsuccessful, better control of water tables within a district and opportunities to market both vegetables and cane by contract gives some hope for this form of economy in the future. At present subsistence farming is found almost entirely on the burned lands of the southwestern sector (Figure 18).

The future will probably see greater emphasis upon some industrial crops such as soy beans, castor beans, and

lemon grass (for their oils), sweet potatoes (for starch), bagasse (for insulating material and interior wall covering), and peanuts (for plastics). Local processing plants for these or other farm products would tend to stabilize both the financial structure and the seasonal labor demands of the Upper Glades.

The nice balance between abundant rainfall for the cane growing season and the dry sunny weather of the cane maturing and harvesting period results in a high sucrose content. Cane has been bred for frost resistance so that the occasional Everglades frost causes little damage; it is not necessary to replant annually as in Louisiana. The flat terrain of this marshland facilitates a high degree of mechanization. Only Cuba, of sugar growing regions supplying the United States, has lower growing cost than the Upper Glades.

Beef production will continue to expand on planted pastures of Para (*Panicum purpurascens*), Napier (*Pennisetum purpureum*), Bahia (*Paspalum notatum*), Dallis (*Paspalum dilatatum*), and other adaptable grasses. Supplemental feeds, such as Egyptian wheat, sorghum, sweet potatoes, cowpeas, teosinte (*Cuchlaena mexicana*), and corn can easily be grown. Freezes damages only grass tops, not the roots. Dairying also would seem to be an imminent possibility because of the great demand throughout south Florida. Suitable varieties of semi-tropical and tropical trees could provide both shade and some fodder for cows, as suggested by Dr. John C. Gifford, Professor of Tropical Forestry and Conservation at the University of Miami.

Summers are favorable for growth of ramie (*Boehmeria nivea*), a hardy perennial of the nettle family, useful for making superior fabrics and paper. Lack of economical methods for harvesting and decortication have limited acreage of ramie to date.

Vegetable acreage will, therefore, remain nearly constant because the almost frost-free climate constitutes so great an advantage for winter crops of a perishable character. On the other hand, the relative importance will decline, since other crops are also adapted to Everglades edaphic conditions and, doubtless, will soon favorably alter the financial pattern and increase the success of farming.

Excavation of rock for riprap work on the levee faciliated construction of a belt-line canal 80 feet wide and six feet deep following the south shore of the lake. In addition, the St. Lucie canal and Caloosahatchee river canal form a cross-state channel 80 feet wide and six feet deep. Use of these canals cuts shipping costs on petroleum products, machinery, fertilizer, and building materials. Some fruit and vegetable products, timber (from the north shore of Lake Okeechobee), and fish are sent out by canal. There is now virtually no traffic on the Hillsboro, West Palm Beach, North New River, South New River, and Miami canals which in early years furnished the chief means of access to the region. Abandonment

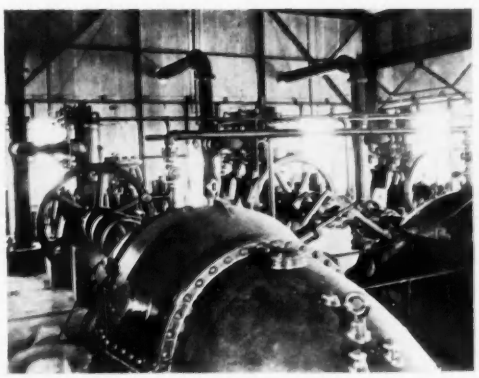

FIGURE 8.—Interior view of a drainage district pumping unit in the Florida Everglades. Capacity approximately 200,000 gallons of water per minute. (Courtesy of U.S.S.C.)

of these canals came in part as a result of rail and highway development and in part because of the difficulties of keeping channels free from clogging by water hyacinths and silt. The general problem of water control is simplified by the decline in water transportation, since lower water levels can now be maintained in the canals with less flood danger to man and crops as the result.

The most serious misconception about the problem of water control in the Everglades was the thought that the land would be ready for agriculture as soon as surface water was removed. Actually, groundwater must be lowered to a depth of from 2.75 to 3.0 feet for cane and from 1.5 to 2.0 feet for vegetables. In such a level land as the Glades, gravity drainage is inadequate. There have been established, therefore, subdrainage districts each of which rims its boundaries with dikes, provides main canals at 6-mile intervals and lateral canals emptying into them, and operates pumping stations to control the groundwater throughout the subdrainage district. Nor is this all of the ditching and draining. Each farmer must provide a system of farm ditches not more than an eighth of a mile apart and mole-drain the area between. The cost of ditching and installing a suitable pumping system ranges from $20 to $35 an acre and 80 acres is about the minimum economical unit.

Important as drainage is, the Everglades problem is not that of drainage but of water control. Prevention of soil shrinkage and burning of soil, and irrigation during the dry crop-growing season all require a system for, at times, returning water to the land. For accomplishing this, the canals, farm ditches, and mole drains are the basis, the only additional requirement being a pumping unit that can pump either direction. Present soil conservation practice is to maintain ground water near the surface on all land not under cultivation.

LABOR REQUIREMENTS

The fact that from 4,000 to 5,000 cane cutters are required to harvest cane from early November until the last of April, and that from 5,000 to 7,500 additional workers are needed to harvest and pack vegetables from October 15 to the first of June, makes it obvious that much labor must be recruited from other farm areas. The United States Sugar Corporation has constructed eleven Negro villages which accommodate about 2,500 workers who dwell permanently alongside cane fields, but substantially less than one-half of the labor force necessary for vegetable production live the year-round near Lake Okeechobee. Who are these seasonal migrants and from where do they come? Who recruits and hires laborers? What are their earnings and their living conditions? How has war affected the labor situation in South Florida?

There are two peak seasons for harvesting vegetables: one in the autumn months of November and December (fall bean picking ends about December 20); the other in March and April when the Glades area is producing its spring crop of snap beans, cabbage, celery, tomatoes, potatoes, and lima beans.

Cool temperatures prevail during the interim of December 15 to March 1, when 67 per cent of all frosts normally appear, thus few laborers are needed to harvest the two hardy vegetables which are emphasized then, celery and cabbage. The two peak periods of labor demand, separated by a mid-winter slack, form a delicate human adjustment to the Glades' cool season, which in turn causes about one-half of the Negroes (some 3,000) to migrate

FIGURE 9.—On September 20, 1932, these Negro bean pickers had been waiting from 4.00 a.m. until 10.00 a.m. to begin harvesting this field. (Courtesy of E.E.S.)

from Lake Okeechobee truck farms to the east coast trucking area, which extends from Florida City to Ft. Pierce. Here during late December, January and February, negroes from the Everglades help harvest beans, tomatoes, peppers, and potatoes. Many then return for the period March 1 to May 1, picking beans again. At least 1,000 Negroes leave the Upper Glades about the first of May. By June 1, only the normal population of the shoreland towns remains and the major harvest period for laborers has ended.

Migratory workers, of which at least four-fifths are Negroes, arrive chiefly by truck, having been recruited from the lower half of the Cotton Belt states. An estimate of the number of transient white girls who help to grade and pack vegetables in some 30 packing houses is approximately 1,500. White men do the heavy work in the packing sheds. Some of the laborers are sharecroppers or owners of small tracts of land. Others continually move from place to place, following the crops from the lower tip of Florida to New York or Michigan, progressing northward along the Atlantic coast or along the Mississippi valley. Still another source of laborers is the part-time farmers who dwell in Florida; in 1940 there were 60 farmers living in Palm Beach county who worked an average of 95 days. Finally, a few thousand laborers can be recruited from among the Negroes who live permanently along the canal banks.

The discontinuity of labor demand on truck farms aggravates the problems of a highly seasonal labor market. Employment opportunities vary from day to day, depending both upon weather conditions and upon growers' estimates of market conditions or actual market prices. Pickers and packers may easily lose several weeks of work because of a freeze, a wind, a severe rain, or low market prices. The production of celery offers steadier work than that of beans, for celery plantings are commonly made five or six times a week, which insures continuous harvesting. Beans cannot be picked when wet, whereas celery can. Equally important is the fact that celery can stand subfreezing temperatures for several hours without being killed. The celery market is also more stable.

Migratory workers are attracted to the Glades truck farms by hearsay, by previous experience, by letter, or by the uncontrolled efforts of recruiting agents. Negro recruiters gather groups of laborers, arrange transportation from farm to farm, and act as foreman in the quarters, but they work along with others in the fields or sheds and receive commissions for this work. Some growers send trucks into the Cotton Belt states for laborers and many furnish this transportation free.

From their living quarters Negroes are trucked to the fields for harvesting duty. They are hired only by the day. As each hamper is filled it is turned in for a check, which is cashed when the day's work is over. Wage rates for Negro field labor fluctuate from day to day and from field to field. For example, when a labor shortage prevails employers may bid against each other for pickers; also, second and third pickings, where beans are more scattered, usually require a higher rate of pay. The quality of vegetables, furthermore, makes for different wages. The average wage rate per field box during the 1941–42 season was 25 cents (first picking), in contrast to about 20 cents for a recent pre-war year. A worker may pick as many as 12 hampers of beans in a day, but there are many days when no beans are being picked; there are also many days when Negroes improvidently refuse to work.

Since passage of the Fair Labor Standards Act in 1938, thirty cents an hour has been the standard rate for white packing-house labor in the Glades. Because of a shortage in help, hourly rates have been advanced to 35 cents, beginning in May, 1942.

A survey made by F.S.A. during the 1941–42 season of the white labor camp Osceola, near Belle Glade, showed that average total family earnings exceeded $25 in only seven weeks of 33 surveyed; the highest weekly average was $36.73 (for the week of May 2). For four of the 33 weeks, family earnings averaged under $10, and for 9 weeks under $15.

Prior to the opening of two permanent migratory labor camps, built by F.S.A. in Belle Glade in 1939, housing and living conditions for transients were as primitive as in many shifting villages in the Tropics. Sanitary arrangements were absent and usually the only source of water was a roadside ditch which also received the refuse of the camper. Three other camps were opened to laborers in 1940 and 1941: one Negro camp at Canal Point, another at Pahokee, and a white camp at Pahokee. One camp at Belle Glade is for Negroes, the other for whites. These five camps can accommodate about 1,600 families. Each camp is a complete community within itself, set up by F.S.A. as a type example in the hope that others will be provided by the private enterprise of growers or operators. Included on the spacious site are an assembly building, a clinic, school, nursery school, canning kitchen, utility building with laundry facilities, comfort stations, and in some, coöperative stores. A camp occupant is charged $1 per week rental fee. About 25 per cent of the camp dwellers stay the year round and it has been estimated that the efficiency of these workers is from 20 per cent to 40 per cent greater than that of Negroes gathered at random from the quarters in Belle Glade.

For the last few years coöperation

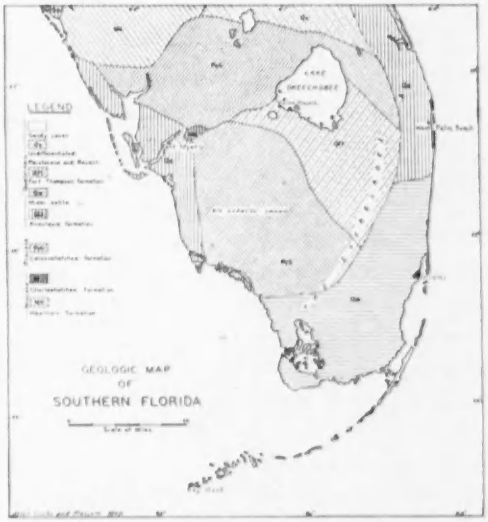

FIGURE 10.—From a test boring for oil completed in 1939 at a depth of 10,006 feet it is shown that sedimentary rocks more than 10,000 feet underlie all of southern Florida. The surface strata are mostly limestones, marls, and calcareous sandstones.

between Glades truck farmers and the United States Employment Service and Farm Placement Service has substantially aided in solving farm labor problems. These two Federal agencies serve particularly in organizing the distribution of labor between the lower east coast of Florida and Lake Okeechobee trucking area. On March 1, 1942 there was a severe freeze in the Upper Glades area with a resulting labor slack period for the next six weeks. There followed several orders for clearance placements for Glades' laborers to go to the east coast, which were arranged by the two agencies.

Vegetable food production has been appreciably increased because of the "food for victory" campaign, in spite of labor difficulties, according to a letter from Dr. J. R. Neller, director of the Everglades Experiment Station (December, 1943). Laborers may be as numerous as in the pre-war period, but many believe there is less labor per man. Bahamans are proving satisfactory in helping to harvest vegetables.

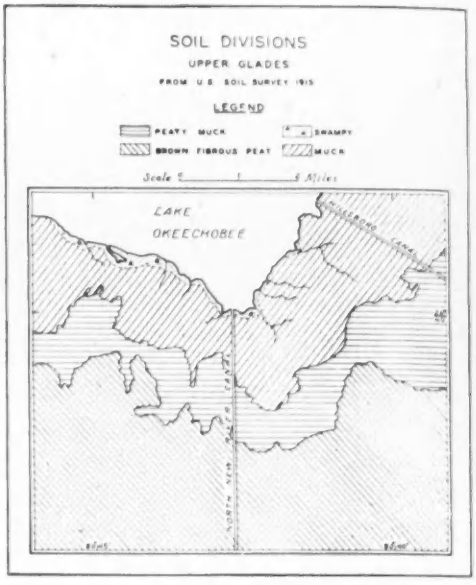

FIGURE 11.—A few farmers dwelling near the lake were raising vegetables when U. S. Soil Survey men were delineating soil types in 1915.

PRODUCTION AND MARKETING

It has been amply demonstrated that successful commercial truck farming in the northern Everglades would never have been possible on the basis of 30- or 40-acre tracts operated independently. Only large farms or coöperatives, employing large-scale farming economies, could have survived the hazards of variable weather and fluctuating market conditions. In the Glades, truck farms of less than 200 acres are considered small. There are a number of farmers who operate over 1,000 acres. Large-scale production is, therefore, necessary, the marsh environment favoring mechanization (which is here so widely employed) and climatic unpredictability fostering diversification (which is now beginning to appear).

Land Costs.—The prospective farmer in lower Florida may buy or rent either developed or "outside" (new) land. Per-acre costs vary according to accessibility, type of drainage, proximity to canals, soil fertility, and development of the land. Undeveloped saw-grass land is priced at $20 to $30 per acre, if roads and canals are adjacent. With decreasing accessibility, the price per acre of saw-grass land declines to a market value of zero. Developed muck land sells for $50 to $500 per acre. Rentals, however, are not proportionate to the sale price of land; for example, muck lands rent for $10 to $20 cash per acre. This suggests that some growers do not have capital available for developing new land, while others lack time. Some men, then, prefer to pay the high rentals, which may be low from the standpoint of net returns if the season is favorable. With improved drainage operations and production methods, greater ease of obtaining clear land titles (since the passage of

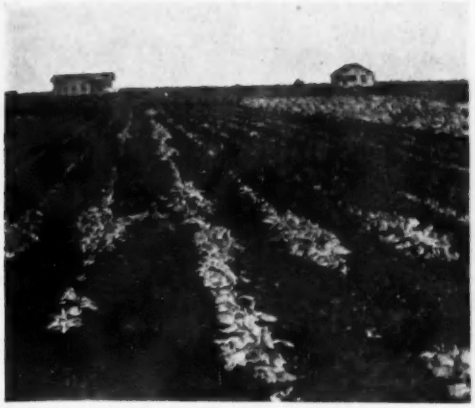

FIG. 12.—An early view showing lettuce growing "in spots" before copper treatment was discovered to be advantageous for plants growing on raw sawgrass peat. (Courtesy of John Newhouse.)

the Murphy Act of 1937) and more equitable tax rates (since the rezoning of the Everglades Drainage District in 1941), not only has speculation been reduced but growers have purchased and developed more "outside" land, holding it in large "blocks." War demand for more food has furthered the trend toward more owner-operated farms. From October, 1940 to April, 1942, between 25,000 and 30,000 acres were sold to prospective farmers.

The cost of ditching and installing suitable pumps on new land approximates $20 to $35 per acre, as estimated by Dr. Neller. Leveling is necessary whenever burned patches are present; this cost varies from a few to twenty dollars an acre. In developing a unit of 640 acres (considered an ideal size) which costs from $20 to $30 an acre, a grower can count on a total cost of between $40 and $50 per acre in getting production underway. He would need in addition about $35,000 for equipment.

Fertilizer Requirements.—Everglades muck and peat contain a rich supply of nitrogen, but they are deficient in phosphoric acid and potash. Some other essential plant foods are lacking also. The Everglades Experiment Station recommends for celery grown on peat an application of 4,000 pounds per acre of a 3–6–6 or 3–6–12 fertilizer to which has been added 100 pounds of manganese sulfate, 100 pounds of copper sulfate and 25 pounds of zinc sulfate. Fertilizer costs per acre of celery in 1937–38 and 1938–39 seasons averaged about $34. For other crops only $5.25 to $6 is considered an average cost per acre for fertilizer. In spite of the present war, there has been no critical shortage of fertilizers.

Cost of Disease Control.—Nutritional diseases may be controlled by the proper application of fertilizers. Wet sprays and dusts are applied regularly once a week whether plants appear to need them or not. Power machinery and airplanes are both used, the latter for certain types of dusting and when the ground is too wet to carry machines. Cutworms, bean leafrollers, aphids, red spiders, nematodes, jassids, and other pests, demand vigilance. Arsenicals can be used up to six weeks before harvesting. An estimate of the cost of disease and insect control, made by

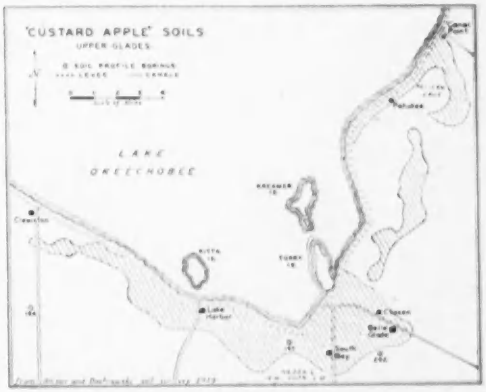

FIGURE 13.—Until 1938–40 most of the vegetables were grown close to the south and east sides of Lake Okeechobee on Okeechobee muck (custard apple) and Okeelanta peaty muck (willow and elder), largely consequent upon better frost protection. At present newly-reclaimed Everglades peat land adjacent main canals and away from the lake is successfully producing some truck.

FIGURE 14.—Marketing vegetables near Belle Glade. (Courtesy of E.E.S.)

H. L. Haney, a successful Glades farmer, is from $10 to $18 per acre. For celery, this cost averaged $16.50 for the year 1937–38 and 1938–39 seasons.

Evolution of Packing and Marketing.—The greatest handicap that early producers in the Everglades experienced in marketing their products was the lack of transportation adequate to move their crops of perishable vegetables to market in fresh condition. From 1914 until as late as 1927, water travel on the lake and canals was very important, but movement of vegetables by open barge was slow and irregular. Vegetables were exposed to rain and sun for from 18 to 24 hours as they floated to Ft. Lauderdale by the North New River canal. Vegetables were then sold on the dock at Ft. Lauderdale through a broker who, in turn, sold to the buyers for commission houses (principally for shipment to New York). Prices offered to Glades farmers at this main market varied with the quality of produce and honesty of the broker. In 1918 the Atlantic Coast Line extended its track to Moore Haven and in 1922 to Clewiston; Clewiston then for a few years became the rail head for south shore shipping. By this time Palm Beach county had built an unsurfaced road from West Palm Beach to Belle Glade, but automobiles had much difficulty in traversing it until the road surface was improved in 1926. The building of Conner's Highway from West Palm Beach to Okeechobee City and construction of the Florida East Coast Railway from Okeechobee southward to Belle Glade in the years 1927 and 1928 put an end to slow boat traffic.

A second early handicap of Glades truck farmers was a lack of packing houses. When transportation by rail and highway became available, packing sheds were constructed, beginning during the period of 1926–28. Standardized and attractive packaging of vegetables was early recognized as essential; thus by the early thirties loosely field-packed beans and other vegetables, often encrusted with muck, had been eliminated. Higher prices were thereby obtained and a more favorable disposition toward Everglades produce resulted.

Marketing.—Present sales of produce are generally made at packing houses to buyers from northern produce firms or over the wire by direct arrangement with the terminal market dealers. Approximately 90 per cent of all sales are made f.o.b. packing houses. A Federal-State Market News office is maintained in the Everglades throughout the heaviest vegetable shipping seasons, supplying free daily marketing information to

both growers and shippers on terminal and f.o.b. market prices, carlot movement, passing, holdings, weather conditions, and information regarding competitive areas. Federal-State Shipping Point Inspection and certification are also available for a nominal fee.

In 1940 there were about 30 packing houses near the lake. Large growers either operate their own sheds or have a considerable interest in private or coöperative packing plants. A few custom packing houses are connected with large northern marketing agencies. Owner-operated plants provide at cost grading, packaging, and selling. Growers with sufficient financial reliability can obtain loans from the Miami Production Credit Association, a Government loan organization providing crop loans at low interest rates. Production loans are granted small farmers for purchase of seed, fertilizer, and other supplies from brokers, packers, or supply houses. In extending credit, these agencies generally assume control over packing and marketing outlets.

Total Production Costs and Profits.—For a recent pre-war year it was estimated that the average cost of producing an acre of vegetables (other than celery) was about $100. This figure was broken down into the following specific costs: rent, $10 to $15; fertilizers, $5.25 to $6; land preparation, $5; planting, $18; harvesting, $32; and packing, $30.

Farm incomes are highly variable from year to year, and from season to season, depending upon markets and weather. A recent study of the bean-trucking district centering about Belle Glade shows that average pre-war farm acreages operated were 170, while acres of cropland were 165; however, the average farm was partially double-cropped so that 280 became the figure for acres of all crops grown commercially. Farm receipts totaled $19,584, farm expenses were $14,747 and the farm income or net return was $4,837. In some years there is no profit shown; indeed, losses are not uncommon. But other seasons will net many thousands of dollars more than the figure for the average farm income of 1934–35. According to H. L. Haney, between $70,000 and $85,000 is necessary to start large-scale farming operations on a minimum of 640 acres of undeveloped land.

Celery is a new crop in the Everglades and is more expensive to produce than other truck crops grown here, but profits appear high. There were in 1940–41 about 4,000 acres utilized for celery production in the Upper Glades. The average net return to growers was $6,500 in 1937–38 season, over $12,500 in 1938–39 season and over $20,000 the next season. Practically all of the celery is produced on Everglades peat soils; celery is less affected by low temperatures than beans, and also celery helps to stabilize farming operations through diversification and by distributing labor more evenly than can be done for other vegetables. Most of the large celery growers do their own processing and marketing independently,

FIGURE 15.—Celery field on the Wedgeworth farm near Belle Glade. (Courtesy of E.E.S.)

or are members of coöperative organizations.

Comparative Growing Costs.—The cost of producing vegetables in the Everglades averages from 25 to 50 per cent higher than northern trucking districts, chiefly because of a longer transportation haul, but also because of water control costs. Only by means of hot-houses, cold storage, canned goods, and more recently frozen vegetables, is there any competition of the north with winter-grown vegetables in Florida. Mexico and Cuba produce vegetables for the United States averaging from one-half to two-thirds of the cost of production in Florida as a whole, attributable to cheaper labor and lower fertilizer costs.

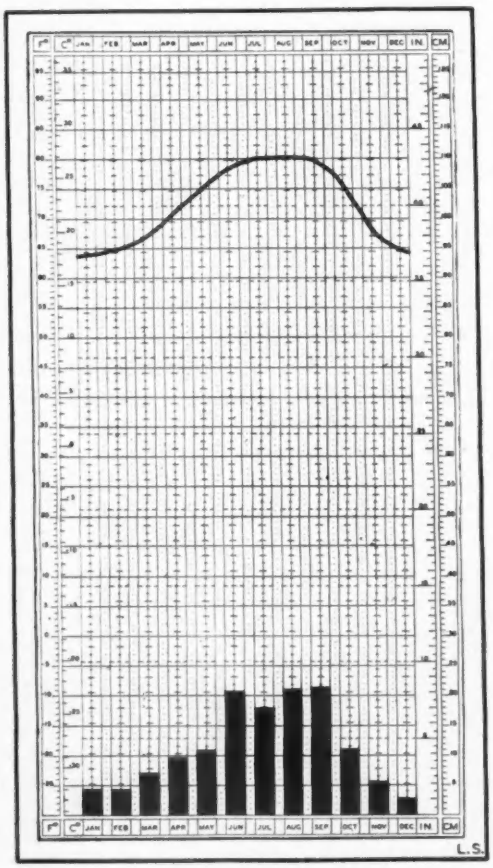

FIGURE 16.—Periodicity of rainfall and seasonality of temperature are shown on this type curve comprising the averages of six climatic stations. (Courtesy of the *Journal of Geography.*)

Competition with Other Trucking Areas.—There is a favorable period during which Glades truck farmers can make most of their shipments in order to escape the bulk of competition from other states. For the four leading vegetables of the northern Everglades, the chief domestic sub-tropical competitors are Texas and California; her foreign rivals are Mexico and Cuba.

Snap beans account for about one-quarter of the total value of Florida vegetable production in a normal year. Florida ships about 70 per cent, or approximately 10,000 carloads, of all the green beans in the United States. Palm Beach County lead in 1939 with 38,768 (61 per cent of the total state acreage), followed by Broward with 13,094 (21 per cent of the state acreage). The percentage in beans is decreasing in both counties, attributable to efforts toward diversification and unwillingness to speculate so heavily upon the fluctuating bean market prices and great weather risks. Lower Glades production is somewhat greater, but competition with imports from Cuba and Mexico has substantially increased since the early thirties. Cuban and Mexican vegetables, moreover, are marketed at the period when south Florida is practically free from domestic competition (November through April). In October beans are also being marketed from Texas and Louisiana, while in mid-May those from Louisiana begin to come in, followed closely by those from South Carolina, North Carolina and other states.

Acreage in celery is increasing in percentage, area, and total volume in the Upper Glades farm economy (Figure 15). Competition comes mainly from the Sanford-Oveido section of Seminole county, from Sarasota, and from California. It costs about $225 per acre to

grow celery in Sarasota, whereas Sanford costs go as high as $250, in contrast to Glades' costs of about $175. It is contended by many that with increasing competition, the Glades will "lift" the other two Florida areas out of major production. From late December until June, Florida markets celery. Stored celery grown in Michigan and New York enters market in December and January. There is also a small amount of celery imported from Bermuda during April, May, and June.

For many years tomatoes have constituted one-quarter of the total value of Florida vegetables, most of the crop being grown in and around the Everglades. From November until June, Florida markets this fruit; the peak of Upper Glades production comes in April and May. The Florida keys, Homestead, Florida City, Manatee, and Ruskin areas provide rather serious home competition. Increasingly in autumn and spring tomatoes are marketed from California and Texas; heavy imports from Cuba and Mexico, on the other hand, invade the markets while Florida is practically free from domestic competition, from December to May. As early as 1930–31 these imports reached 5,347 carloads, whereas Florida shipments totaled 5,333. During the same year Texas shipped out 8,437 carloads. Tomatoes grown for northern markets are becoming less important in lower Florida; they are easily damaged by sub-freezing temperatures, by heavy rains, floods, and soils which have become infested with diseases.

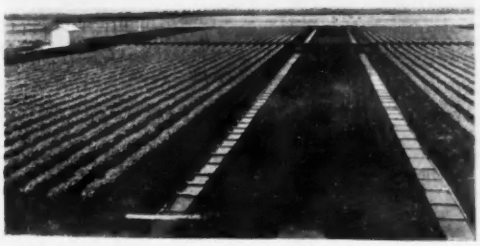

FIGURE 17.—Water-table plots on the grounds of the Everglades Experiment Station. (Courtesy of E.E.S.)

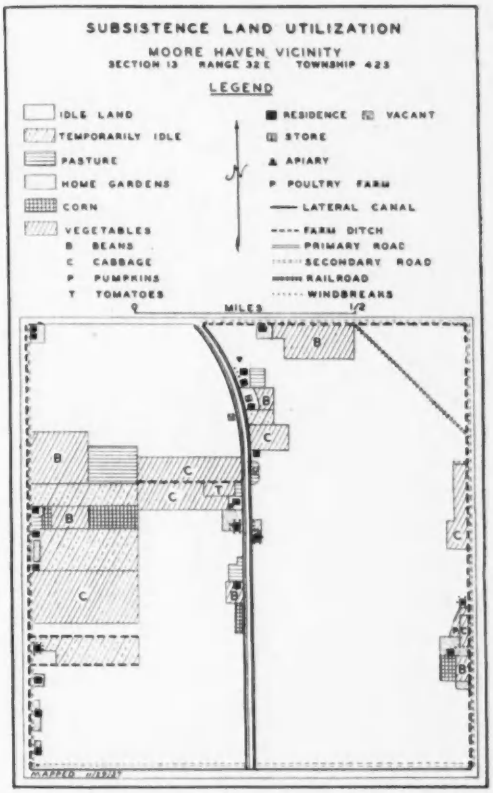

FIGURE 18.—A substantial per cent of this square mile is permanently idle because a few years ago the peat was largely burned. Thus the farm economy represented in the Moore Haven vicinity is subsistence, but does not show evidence in the field of being sub-subsistence.

Cabbage—and also white potatoes—grown in Florida must compete with a large northern stored crop. Uncrated, hard cabbage grown in lower Texas, offers Florida serious competition too and coincides in harvesting and shipping period (December to May). South Carolina, Alabama, Mississippi, and Louisiana are other rival states.

Everglades produce must not only compete with other Florida trucking districts, other states and foreign terri-

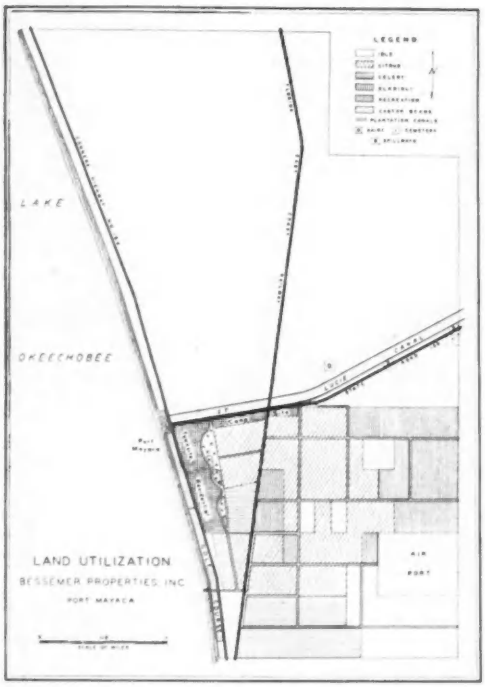

FIGURE 19.—Diversification of farm products, as shown here, is slowly but surely penetrating some sections of the Upper Glades.

tories, but also vegetables must vie with other products for their share of the consumer's food dollar. Attractive and standardized packaging of high quality vegetables is now common practice with Glades producers.

A New Cannery.—A $100,000 canning plant was opened for service near Belle Glade in 1942—the first cannery in the Glades. Beans, as well as other vegetables, formerly had to remain in the fields unpicked when market prices were low. The plant is equipped with machinery to can tomatoes; it is expected that carrots, small potatoes, beets, celery, and spinach will be canned also. The cannery can absorb ten cars of beans daily, or about 7,000 cases. With a canning season of six to eight weeks in the fall and another of the same length in spring, the total annual output will be 600,000 to 750,000 cases. In 1942, between 2,400 and 2,500 acres were contracted for by the plant, payment being made in advance at three cents a pound (or 90 cents a bushel) delivered to the platform as the beans come from the field This acreage, normally will provide full operation for the plant. It is contended locally that the future for canning in the Glades is to make some use of the surplus when the market price falls low. At present snap beans are canned only for Army use.

FIGURE 20.—Seminole Indian cowboys watering their part-Brahman herd of beef cattle. More pastures and cattle should constitute valuable supplementary gains in the vegetable and cane-sugar economies now well established.

SUMMARY

Land utilization in the northern Everglades is characterized by both intensive and specialized methods of farming. A recent trend is toward a program of diversification (Figure 19). Both large and small growers are now cognizant of the need for growing a greater variety of produce in order to (1) stabilize financial returns, (2) provide for up-keep of the soil, (3) inaugurate summer land use, (4) create a steadier demand for labor, and (5) maintain local facilities for processing of some produce. Research projects of the Everglades Experiment Station and the United States Sugar Corporation have demonstrated the suitability of many crops for prevailing conditions. A recent land planning report of Palm Beach county also offers suggestions for profitable use of the land. A farmer resident in the Everglades for 30 years. Mr. James E. Beardsley, believes that " . . . four items—sugar, starch, beef, and fiber—are all lines which offer reasonable stability as compared with the hazard of vegetable production, which latter will continue to keep a prominent place in the agricultural economy, because of the prospective profits within an area subject only occasionally to freezing temperatures such as that adjacent to the lake." "There has been no major change in the kinds of vegetables grown because of war-time conditions," according to Dr. J. R. Neller, of Belle Glade, in a letter of December 28, 1943.

GRAPHIC SUMMARY OF TRADE BETWEEN THE UNITED STATES AND THE OTHER AMERICAS*

Wallace W. Atwood

NEVER before have the peoples of the Western World been more conscious of their interdependence and of the many advantages that may come from expansion of their trade relationships. Never before have we been forced to turn to the nearby tropical lands for so many raw materials formerly imported from far away lands between the tropics of Cancer and Capricorn.

The fact that the inhabited lands of the Americas stretch through more than 100 degrees of latitude, explains many of the widely different climatic zones in the lands of the Western Hemisphere. Since this great expanse of habitable lands crosses the equator and extends into the north and south temperate zones, the crop regions on the two sides of the equator are in many ways complementary. The extensive wheat-producing lands of North Dakota and Canada are buried in snow at the time when wheat is being harvested in the Argentine. Our corn is harvested in August or September but in the south temperate zone corn is taken from the fields in March or April. Wool is clipped from the backs of sheep at widely separated periods in the Northern and Southern Hemispheres. Cattle and sheep are fattened and prepared for the market at different times. As time marches on much greater advantage may be taken of the complementary periodicity of the climates in North and South America than has yet been dreamed of.

The tropical lands of the Americas are already providing products that move in part northward and in part southward. The warmer lands are a great asset to all the peoples in the Western World and as time passes and more fruits, hemp, sisal, chicle, quinine, mahogany, balsa wood, and crude rubber come from these warmer areas to the cooler lands, we shall recognize more fully than we do today the value to all of us of the very warm, moist lands between the Tropics of Cancer and Capricorn. Comparatively little attention has been given as yet to the economic development of the tropics.

In the brief paragraphs which accompany the graphs prepared for this article we shall review the salient facts pertaining to the trade between the United States and other Americas in 1940. The data used are the latest that can be released. War has interrupted the even flow of commerce of the world and at this moment trade is undoubtedly somewhat different in amounts from that reflected in the diagrams. Nevertheless the figures indicate in a very accurate and significant way the areas of certain surplus products and the normal movement of such commodities. The diagrams show at a glance what the different nations of the Western World wish to sell and what they need to buy.

Our Trade with the People of Canada. There is a great difference in the number

*The charts on which this article is based were prepared by Guy H. Burnham.

of people in Canada, about 12,000,000 and the number in the United States of America, about 137,000,000,but the trade between the peoples to the north and south of our northern international boundary line is not in the same proportion. In 1940 we purchased from the Canadian people about $744,000,000 worth of various products, and we sold them products worth about $443,000,000. The chief reason the Canadian people purchase so much from us is that they look to us for a huge amount of iron and steel products and they turn to us for a vast amount of non-metallic minerals. The heavy imports from the United States in 1940, must be due in part to the war emergency, for during normal times, we do not sell nearly as much in the way of machinery, supplies of iron or steel, or vehicles, as we have during this period.

Our purchases from the people to the north are chiefly in wood and paper. Their vast expanse of forest lands is proving to be a wonderful asset to the people in the Dominion of Canada. In 1940 they sold to us over $214,000,000 worth of products that came directly from their forests. We look northward also for supplies of nickel, asbestos, and platinum, as well as some agricultural products.

NEWFOUNDLAND AND LABRADOR. The people in the northeastern portion of the continent send us large quantities

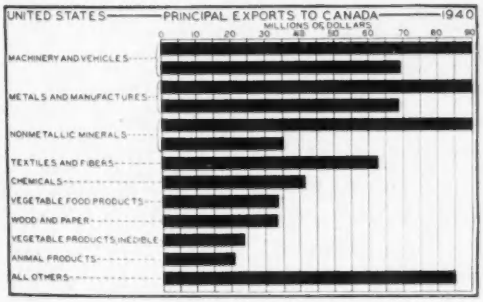

FIGURE 1.—United States—Principal Exports to Canada—1940.

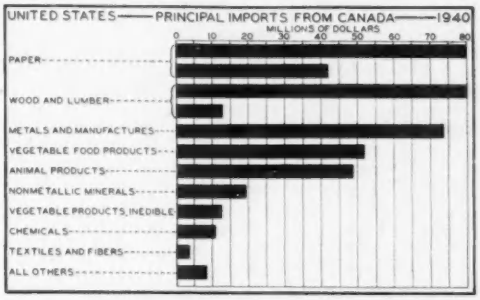

FIGURE 2.—United States—Principal Imports from Canada—1940.

of wood. We secure some fish from that part of the world and the vegetable products, which we import from Newfoundland, curiously enough, are blueberries.

In exchange we export to the people of Newfoundland and Labrador considerable food, machinery, vehicles, and certain textiles.

GREENLAND. Sometimes we forget that Greenland is a part of the Western World and that our trade with Greenland is of extreme importance to us. That land is our chief source for cryolite and we purchase over a million dollars worth of the pale grey-white mineral,

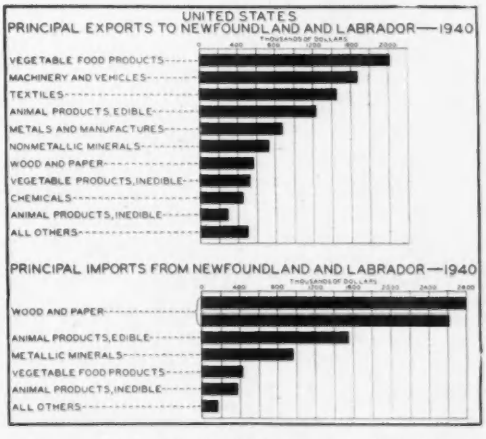

FIGURE 3.—Principal Exports to Newfoundland and Labrador—1940.

from the west coast of Greenland, every year. It is a source of aluminum but it also contains sodium. The people

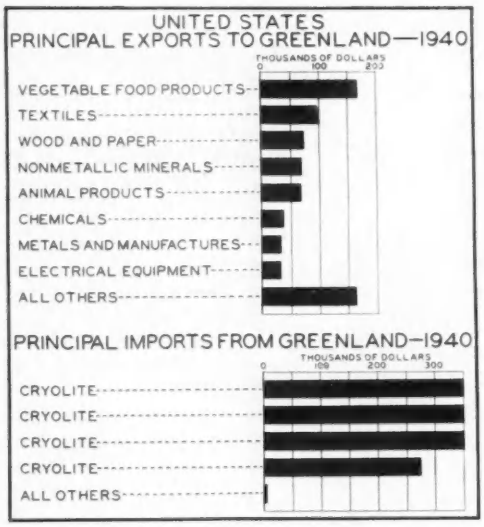

FIGURE 4.—Principal Exports to Greenland and Principal Imports from Greenland—1940.

of Greenland take in exchange vegetable products which they cannot raise so far north and textiles, as well as a large variety of other supplies which they enjoy having and which they cannot very well produce.

MEXICO. Our nearest neighbor to the south, on the mainland of North America, is Mexico. The commerce between the United States and that country, as reflected by the two accompanying charts, indicates that to the people of Mexico we are a great manufacturing organization. Their chief purchases from us are machinery, metals, manufactured goods of various kinds, and vehicles. The vehicles are automobiles, motor trucks, buses, and wagons.

When we look toward Mexico for products of value to us we discover that our nearest neighbor to the south is rich in metallic ores and petroleum. The lowlands of that country have a tropical or subtropical climate which produce certain vegetable food products, chiefly bananas, which we enjoy. On the peninsula of Yucatan large supplies of henequen and sisal, which we need for binder twine and rope are grown.

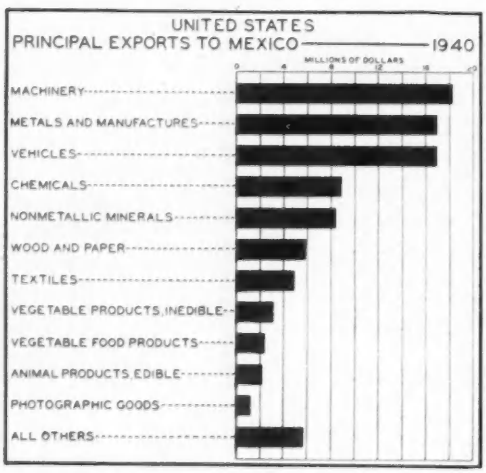

FIGURE 5.—Principal Exports to Mexico—1940.

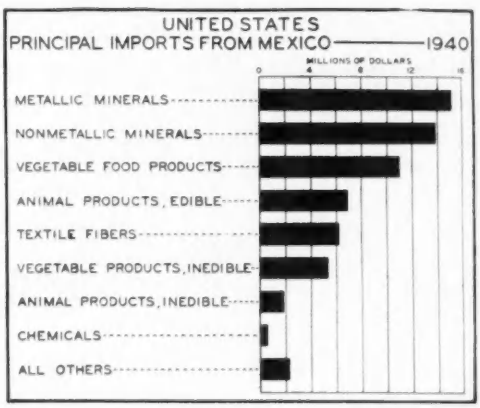

FIGURE 6.—Principal Imports from Mexico—1940.

The oil fields are on the coastal plain near the port of Tampico. Much of the crude oil from that field is taken across the Gulf of Mexico to refineries on the southern coast of Texas. The refined products are then shipped to various parts of the United States.

BRAZIL. We purchase about $54,000,000 worth of coffee from Brazil in one year. That is not half of all the coffee we consume but it far exceeds in value our other imports from Brazil. We turn also to the largest of our South American neighbors, a country with a territory exceeding that of the United

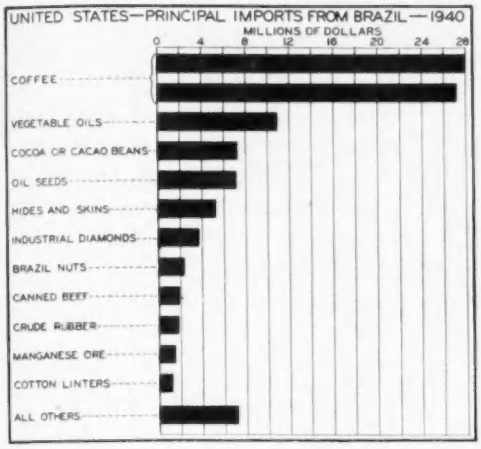

FIGURE 7.—Principal Imports from Brazil—1940.

States with 47,000,000 people, for vegetable oils and, because we are great lovers of chocolate, for a considerable quantity of cacao beans. During the war period Brazil is furnishing unusually large amounts of industrial diamonds, manganese, and quartz crystals.

We look forward to receiving an ever-increasing amount of crude rubber from the lowlands of the Amazon. That region has become the scene of great activity. One hundred thousand latex gatherers are moving in with their families and establishing homes in the greatest rain forest of the world, where there are 300,000,000 wild rubber trees. Millions of dollars have been made available by the United States Government for improvements in the sanitary conditions near the homes of the rubber gatherers, for establishing medical stations, infirmaries, and new plantations of rubber trees. At least 70,000 tons of crude rubber are expected from the Amazon in 1944, and still larger supplies as soon as the seedlings of today begin to yield the latex from which the rubber is made.

Brazil turns to us chiefly for machinery, coal, wheat, and petroleum products. As the chart of exports from the United States to Brazil indicates, we appear to the Brazilian people as very skillful manufacturers of useful machinery, of remarkable vehicles for pleasure and for business, and of thousands of mechanical gadgets used in industry and in the home.

Brazil has not as yet become predominantly a manufacturing country and while that condition remains, we in the United States may look to the Brazilian markets for the distribution of many of our surplus products from factories, mills, and foundries. However, manufacturing is moving forward in Brazil and in some of the other Latin American countries. It is not difficult for people to imitate us in industrial processes. The next few years may see notable progress in the establishment of manufacturing plants which will use local raw materials and produce many of the consumer-goods needed in the southern republics.

URUGUAY. The three long bands across the chart representing the values of our principal imports from Uruguay reflect clearly the life and culture in the gently rolling grassland of South America. In that country where sheep have their own highways, where they dominate the landscape throughout much of the national domain, wool, meats, hides, and skins are among the outstand-

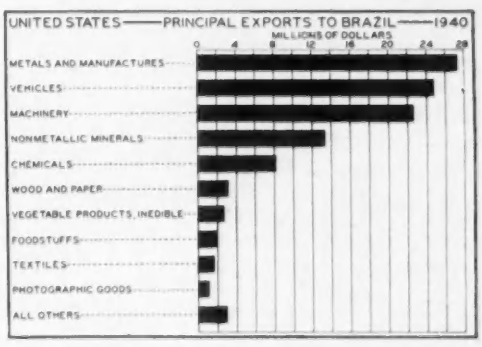

FIGURE 8.—Principal Exports to Brazil—1940

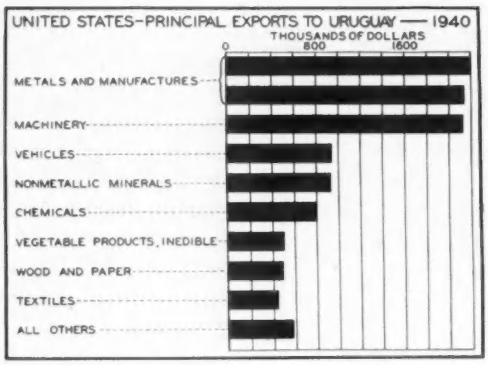

FIGURE 9.—Principal Exports to Uruguay—1940.

ing surplus products. Uruguay is a land of pastoral people, a land where ranchmen, gauchos, sheep herders, wool clippers, balers, and shippers give character to the village scenes, color to the conversation, and wealth to the nation.

The people of Uruguay buy from us large quantities of manufactured goods, machinery, and vehicles. They have their cities, public institutions, and homes well equipped with all the modern conveniences which a great manufacturing country, such as the United States, can produce.

ARGENTINA. The exports from Argentina to the United States reflect, at a glance, the pastoral culture in that country of the south temperate zone. There, where 12,000,000 people live, most of the land is used for grazing sheep and cattle. The dominant textile fiber received from Argentina is wool, but we also import some flax from it. Animal products, such as hides and

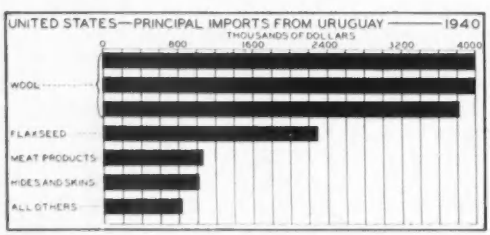

FIGURE 10.—Principal Imports from Uruguay—1940.

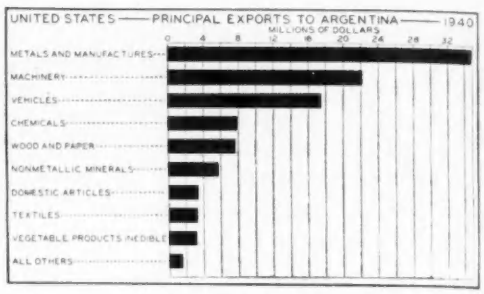

FIGURE 11.—Principal Exports to Argentina—1940.

skins, form an important part of our trade with the Argentinians, but if we would accept more of their meats the trade in animal products would undoubtedly be greatly increased.

Beef cattle produced on the rich grasslands of the Argentine furnish some of the most edible steaks and roast beefs that can be obtained anywhere in the world. In normal times Argentina finds an excellent market in western Europe and in the British Isles for any products that we do not wish to purchase. Her neighbors Brazil and Chile also purchase some of her surplus products. The export trade of the Argentine is the foundation of the relatively high standard of living there.

Again the Argentine people, as the people of so many of the neighboring countries among the Americas, think of us as the producers of wonderful vehicles, of machinery which will help them in their great frigorificoes, in their new textile mills and shoe factories. They purchase also many prod-

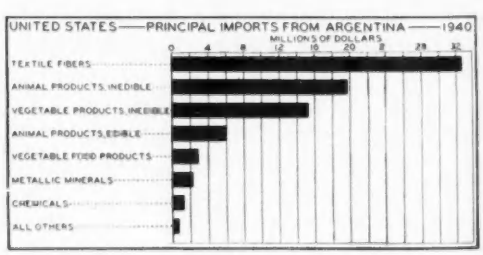

FIGURE 12.—Principal Imports from Argentina—1940.

ucts made of metal in this country and other manufactured goods.

PARAGUAY. We look to Paraguay primarily for the extract from the very hard, heavy wood called quebracho. The extract is used in tanning leather. We sell to Paraguay chiefly metal goods and vehicles. Paraguay is a country little larger than the state of California, with a population of a million people. It has not as yet become a manufacturing country, and for many years to come we may anticipate that our trade with the people of that country will be an exchange of our manufactured goods for their raw materials.

CHILE. The two outstanding products of Chile, which we import, come from places where the rocks and soils have been richly mineralized. The copper from Chuquicamata comes from a hillside so impregnated with the ores that the rocks, where freshly exposed, have the azure blue, the deep greens, or the dark purples of copper ores. The entire hill where the ores were discovered is so rich in copper that it is all taken, as it is cut down, to the mill for smelting. Other copper ores come from deep mines southeast of Santiago and high in the Andes mountains.

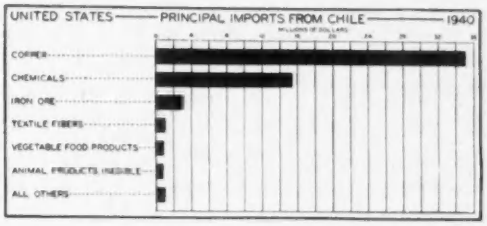

FIGURE 14.—Principal Imports from Chile—1940.

The chemicals are chiefly nitrates obtained from the soils in the desert of Atacama. The nitrate salts were brought from the hills far to the east by waters that have moved in subterranean passageways until, in the dry air of the desert, they were evaporated. By this process the nitrate salts were precipitated and left in the soils or surface rocks. Thus, by digging 10, 20, or 30 feet into the earth of the desert region, men find disintegrated rock material which is richly impregnated with the valuable salt.

Chile looks to us for no special products other than those that the people of other South American countries desire from us. They want our automobiles, typewriters, and various kinds of machinery. They purchase tools and many kinds of mining machinery. To the 5,000,000 people living in the

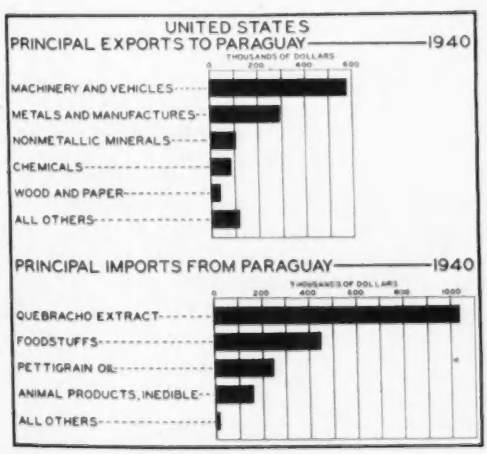

FIGURE 13.—Principal Exports and Principal Imports from Paraguay—1940.

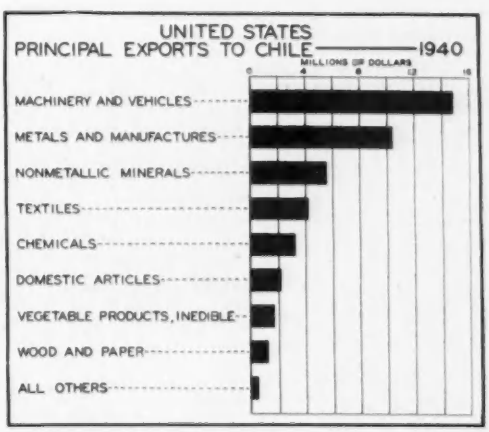

FIGURE 15.—Principal Exports to Chile—1940.

elongated country, stretching for 2000 miles along the west coast of South America, we are the makers of all kinds of useful gadgets. Some day they will learn how to manufacture some of the same things and not need to import so much from us.

BOLIVIA. The chief activities in this country, high among the Andes, are reflected by the black bands on the chart opposite the words tin, tungsten, antimony, and lead. Bolivia is a mining country. Of the three million people who live there, many work underground much of the time. We want all of their tin, tungsten, and antimony and will take more than they can produce.

They turn to us for the machinery needed in mining, for manufactured goods, and for vehicles. It is the homeland of our white, or Irish potato, and it is still produced by the native people, but Bolivia is not a land where agriculture prospers.

PERU. Peru is another country rich in copper ores and contributing large quantities of that valuable metal to the rest of the world. We take the largest part of all the copper concentrates produced there. Peru is a very rich region in mineral resources and we turn to it for vanadium, lead, and zinc. The inedible animal products which we like to have from Peru come chiefly from the backs of llamas and alpacas, and occasionally from the vicuna.

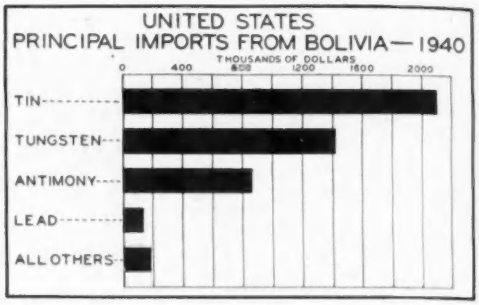

FIGURE 17.—Principal Imports from Bolivia—1940.

Each year we send millions of dollars worth of iron and steel to Peru and millions of dollars worth of the best in mining machinery and tools. The Peruvians are developing some home industries and they purchase machinery for use in their local factories and mills. They produce an excellent grade of cotton and there is no reason why they should not develop a textile industry. Each year they purchase a large number of our automobiles. Many of their roads are very rough, and no machine can stand up very long with the terrific pulls which they make with cars to fifteen or eighteen thousand feet above sea level. However, as automobile highways are being improved the American-made machines are more and more in demand.

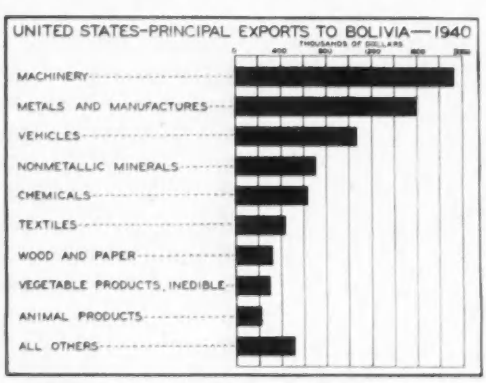

FIGURE 16.—Principal Exports to Bolivia—1940.

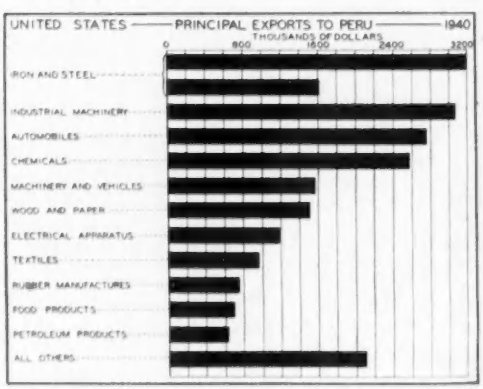

FIGURE 18.—Principal Exports to Peru—1940.

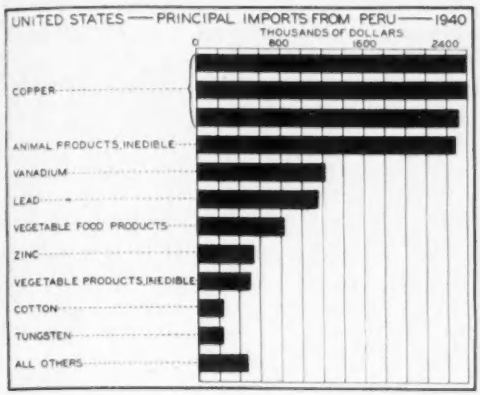

FIGURE 19.—Principal Imports from Peru—1940.

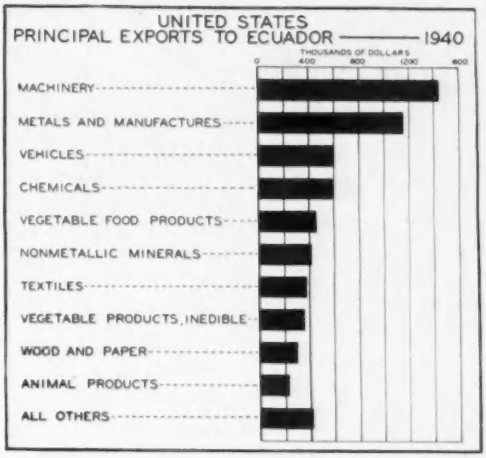

FIGURE 20.—Principal Exports to Ecuador—1940.

ECUADOR. This comparatively small country, midway between the North and South poles of the world, sends us a large portion of the cacao beans which we purchase and a considerable amount of coffee. It is the true homeland of the so-called Panama hats, for they are not from Panama. The first ones which came into a foreign market, though they came from Ecuador, were sold in Panama. As the Amazon lowland rubber industry is developed we hope Ecuador will produce some of that much needed product. Today Ecaudor produces a large proportion of the balsa wood used in manufacture of fighter planes, life preservers, and buoys. Balsa is lighter than cork and twice as strong.

When we inspect the chart, which reflects our sales to Ecuador, we see that, like the neighboring countries of South America, the Ecuadorians think of us as the makers of electric irons, toasters, percolators, sewing machines, electric razors, refrigerators, radios, victrolas, typewriters, and a thousand more very useful articles which they are not equipped to make. We are the people who can manufacture wonderful automobiles and all kinds of machinery. Their chief imports from us are in the same categories that appear conspicuously at the head of the imports lists for most of the Latin American countries.

COLOMBIA. Colombia, at the northwestern corner of the continent of South America, a mountainous land, with nearly 9,000,000 people, is the second great coffee-producing country in the Western World. We purchase about $43,000,000 worth of coffee in one year from the people of Colombia. When we add this to the value of the coffee purchased from Brazil we have the total bill for our favorite breakfast beverage of $100,000,000 a year. That is not all the coffee we use. We purchase coffee from Ecuador, El Salvador, Costa Rica, Guatemala, a little from Venezuela, a large supply from Nicara-

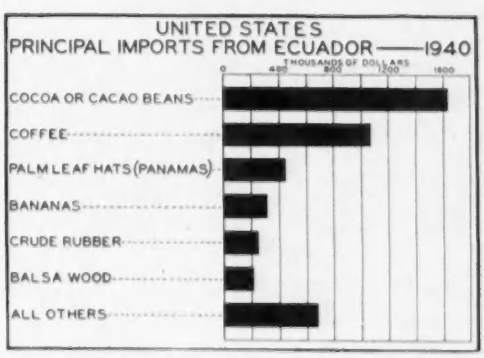

FIGURE 21.—Principal Imports from Ecuador.

gua, and a little from Honduras. Our total annual bill for coffee is about $150,000,000.

A glance at the chart showing the exports from the United States to Colombia tells the same old story. We, to them, are busy making tools, and all kinds of clever machines. These they like to purchase, for as yet they have developed no interest for making such articles.

VENEZUELA. Venezuela spells to us, when we think of imports, the word petroleum. Other products coming from that country are comparatively insignificant in their values. We want the mineral oil, which comes from deep below the surface in and about Lake Maracaibo. We do not purchase all of their petroleum. Much of it goes to the little Dutch islands nearby and in normal times the refined products find their way to many different countries.

Venezuela buys machinery, fuels, metals, and manufactured goods in large quantities from us. To the people of that country we are busy day and night devising thousands of mysteriously remarkable machines that make the work in the home and factory easier. They have not, as yet, bothered themselves about making such things.

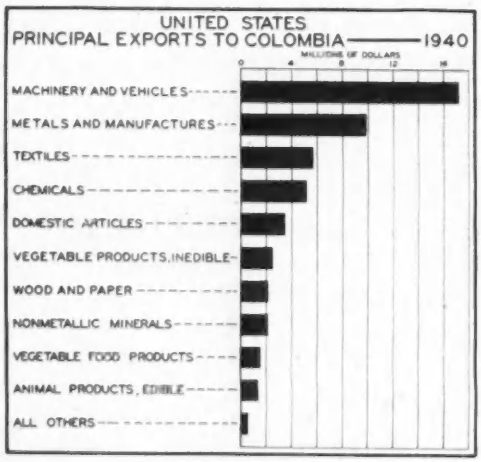

FIGURE 22.—Principal Exports to Colombia—1940.

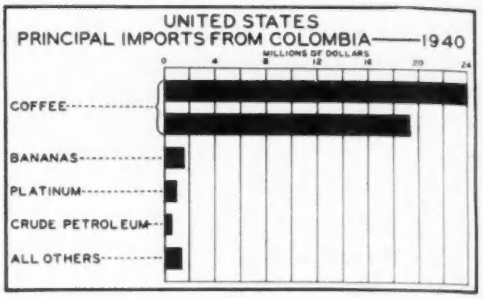

FIGURE 23.—Principal Imports from Colombia.

CURAÇAO. On the Dutch island of Curaçao there are huge refineries where the petroleum from the mainland of South America, chiefly from Venezuela, is broken up into its various useful elements. Oil products are sold by the millions of dollars worth to the people of the United States. Our imports from Curaçao are chiefly residual fuel oils and unfinished oils for further processing. High grade motor fuels heads the list of our sales to the people in the little Dutch island. We sell them large quantities of other refined products from petroleum. In addition to the non-metallic products we send them machinery, metal goods, some foods, and textiles.

THE GUIANAS. The three small colonial possessions in South America held by the British, Dutch, and French are grouped together in this chart. The British and Dutch possessions, and especially the latter, yield bauxite, the chief source of aluminum and we purchase virtually all of their output. In exchange the peoples of the Guianas

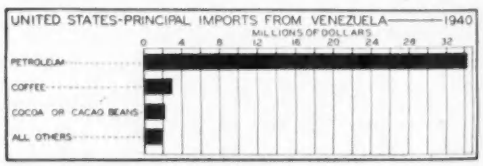

FIGURE 24.—Principal Imports from Venezuela—1940.

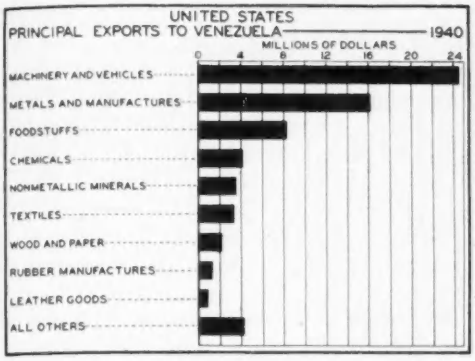

FIGURE 25.—Principal Exports to Venezuela—1940.

do as so many of the Latin American people and purchase machinery, vehicles, metal goods, and a long list of other products as shown in the chart.

PANAMA. Panama has less than 600,000 people in normal times and an area about equal to that of the state of Maine. When conditions of shipment are favorable bananas and cacao beans are the chief products which we import from the people in Panama. Their purchases from us are notably vehicles, which we excel in manufacturing, and other kinds of machines and metal goods. Like other peoples in tropical countries they purchase considerable quantities of our textile goods. Before we were able to supply Latin American people with textiles they manufactured their own cloth and made their clothing

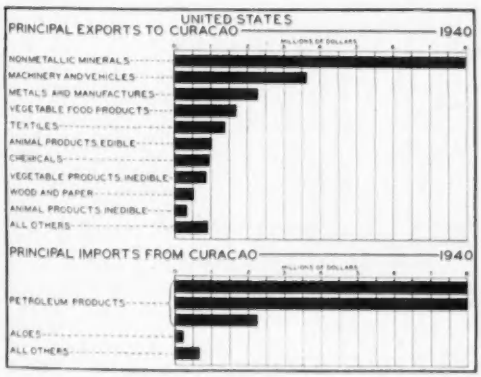

FIGURE 26.—Principal Exports to and Principal Imports from Curacao—1940.

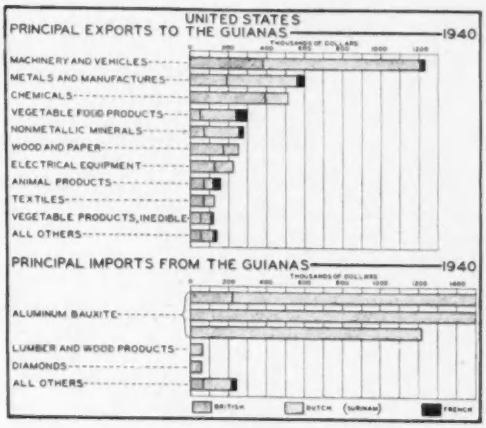

FIGURE 27.—Principal Exports to and Principal Imports from the Guianas.

by hand. Many of the native peoples carry on in that way even to this day.

COSTA RICA. This is a small country with about 600,000 people and a territory about the size of the state of West Virginia. It is, for the most part, a hilly land, and where the altitude is great enough the climate is temperate; nevertheless it is a land of bananas, coffee, and cacao beans; three of the typical crops of the tropical lowlands. The chief purchases which the people of Costa Rica make from us are in metal and manufactured goods.

NICARAGUA. This is another very small country about the size of the state of Alabama with a population of about 750,000. Our trade with the people is chiefly in the purchase of coffee and, in normal times, bananas. Our sales to them are again those ever recurring elements for which the United States is known throughout the world. We are a people with industrial ingenuity, with energy for the development of factories, mills, and shops. We make the tools, machines, vehicles, and many small gadgets for much of the rest of the world.

EL SALVADOR. El Salvador is another coffee-producing country selling a large part of their surplus to us. We

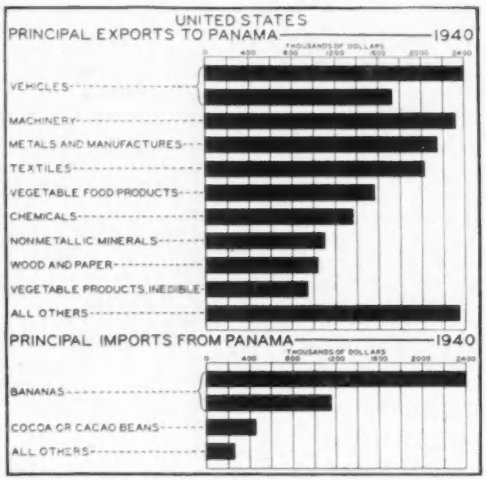

FIGURE 28.—Principal Exports to and Imports from Panama—1940.

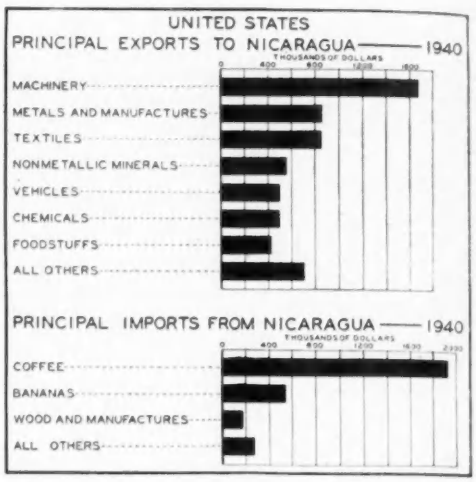

FIGURE 30.—Principal Exports to and Imports from Nicaragua—1940.

buy nearly $7,000,000 worth of coffee each year from the people of that little country, where the population is less than 2,000,000 and the area about equal to that of Massachusetts, Connecticut, and Rhode Island combined. We sell chiefly textile products, some of our machinery, and metal goods.

HONDURAS. On the east side of Central America this little country of 44,275 square miles, about the size of the state of Pennsylvania, with a few more than 900,000 people, has been a land famous for bananas. What they are doing now is hard to tell. Some of their banana lands have been transformed into plantations of sisal, henequen, or abacá. The people of Honduras must be handicapped by the shortage of shipping facilities which would make possible the sale of huge quantities of bananas in the United States.

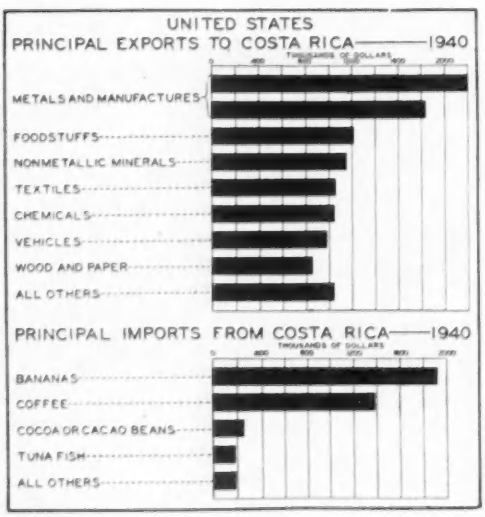

FIGURE 29.—Principal Exports to and Imports from Costa Rica—1940.

During normal times the people of Honduras looked to us for metals, machinery, and vehicles. They think of us chiefly as wonderfully skillful in the arts of manufacture.

GUATEMALA. This is another coffee-producing region. During normal times, even as late as 1940, the country produced large quantities of bananas which were shipped across the Gulf of Mexico into the United States or around the point of Florida to Atlantic coast ports. Yes, we have no bananas, but that we hope is temporary. Some of the plantation lands have been appropriated for fiber-producing plants, such as sisal, henequen, and abacá. Somewhere in Central America, or in other tropical lands in the Western World

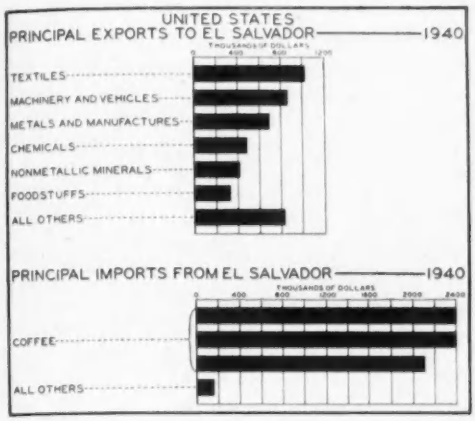

FIGURE 31.—Principal Exports to and Imports from El Salvador—1940.

bananas will someday come back into production.

We sell to the people of Guatemala large quantities of textiles. Like so many of our other neighbors, the Guatemalans turn to us for machinery, vehicles, and all kinds of metal goods. The native peoples living in villages far back in the interior among the highlands of Guatemala produce homespun cloth which is made into very attractive blankets and scarves. Their pottery is home-made also. The city dwellers demand cloth like that used in the United States and western Europe.

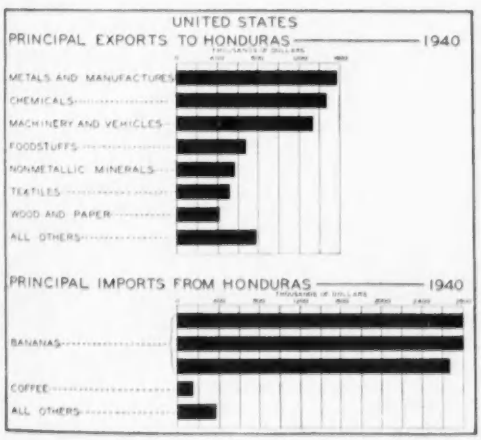

FIGURE 32.—Principal Exports to and Imports from Honduras—1940.

CUBA. This beautiful subtropical island, which has served for a long time as a sugar bowl for the United States and for other parts of the world, continues to sell huge quantities of that product to us; sixty-eight million dollars worth of sugar cane to the people of the United States from Cuba in 1940. Over $11,000,000 worth of molasses came also. Cuba is also famous for high-grade tobacco. We purchase each year from the Cubans nearly $10,000,000 worth of tobacco and tobacco products.

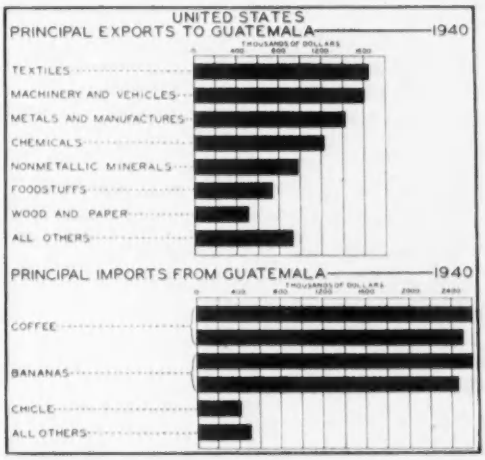

FIGURE 33.—Principal Exports to and Imports from Guatemala—1940.

During the war, Cuba is making every effort to meet our demands for more manganese, copper, iron, and chromium. In this respect, as in many others, Cuba is making a supreme effort to coöperate in every way possible to help the allied nations win the war.

Our sales to Cuba differ from those to many of the other countries to the south of us. The people of Cuba call upon us for a large quantity of foodstuffs. They particularly like our wheat flour and rice. They like the fruits and vegetables of the temperate zone. They are a people who like to have the products of our textile mills.

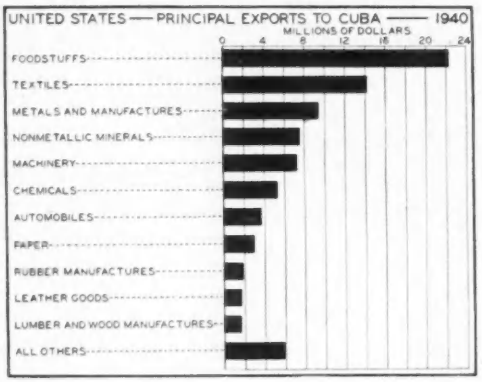

FIGURE 34.—Principal Exports to Cuba—1940.

Cotton is the cloth most commonly used by those living in subtropical lands, but the Cubans purchase many of the best of our fine woolens and rayon fabrics. Here we find that the importation of metal goods, machinery, and automobiles are farther down the lists. They are not at the top of the list as in so many other instances among the neighboring countries in the Americas.

THE DOMINICAN REPUBLIC. The island people of this republic are engaged chiefly in agricultural pursuits. The products which we purchase from them, as listed on the accompanying chart, reflect very clearly the activities of the people. When we turn to our exports to those people we see at the top of the list machinery, vehicles and various manufactured products in which metals are used. To be sure we do

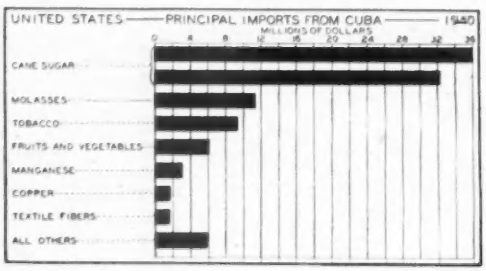

FIGURE 35.—Principal Imports from Cuba—1940.

FIGURE 36.—Principal Exports to and Imports from Dominican Republic—1940.

forward to them considerable quantities of textiles and some non-metallic minerals. The contrast between the activities of the people providing surplus products in this little republic, and the activities of the people in our country who produce surplus products, is very marked.

HAITI. Again we have a people who

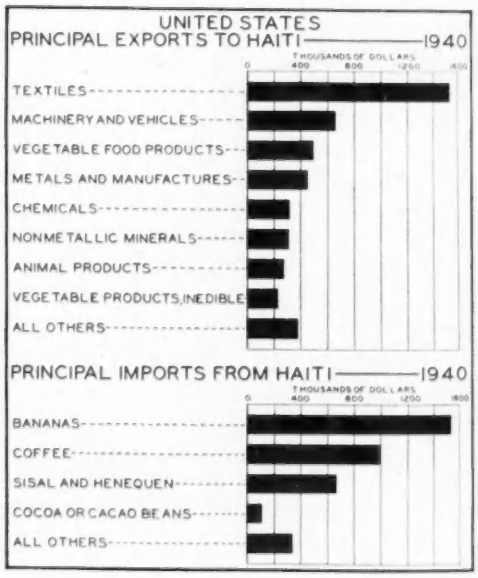

FIGURE 37.—Principal Exports to and Imports from Haiti—1940.

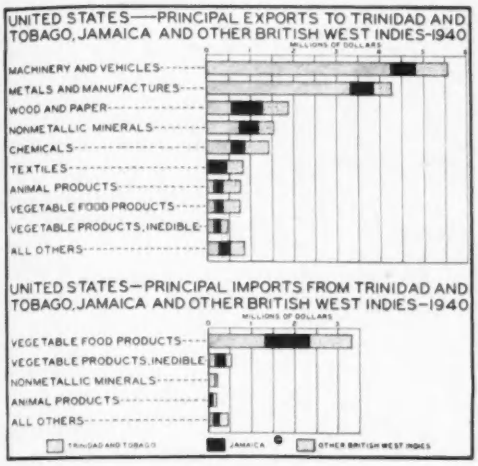

FIGURE 38.—Principal Exports to and Imports from Trinidad and Tobago, Jamaica, and other British West Indies.

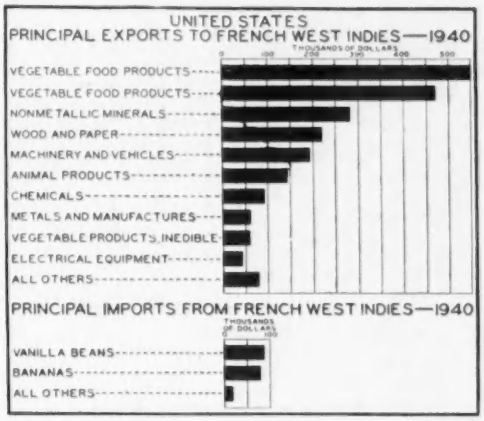

FIGURE 39.—Principal Exports to and Imports from French West Indies.

are agricultural in their pursuits and activities. They turn to us for various textile products as well as machinery and vehicles.

TRINIDAD AND TOBAGO, JAMAICA, AND OTHER BRITISH WEST INDIES. We have grouped the smaller British possessions of the West Indies in a single chart without introducing any complexity. It is perfectly clear that our purchases from the people in these tropical islands are largely in vegetable products and our sales to them are in machinery, vehicles, and metal goods.

FRENCH WEST INDIES. There are a few small islands in the West Indies still held by the French. Our trade with the people of these islands is chiefly in food products produced in the United States which they cannot very well produce in large quantities on their little islands. They send us vanilla beans, bananas, and other tropical products.

BRITISH RAILWAYS AND MOTOR ROADS IN THE MIDDLE EAST—1918–1930*

Morton B. Stratton

THE close of the first World War found the continent of Asia dominated by three great powers. The Russian colossus bestrode a broad belt of territory, in temporary confusion, stretching across the northern half of the continent from Poland to the Pacific. The British Empire and dependent regions formed a second great belt of territory stretching across the southern half of the continent from the Mediterranean to the South China Sea. Wedged in between the two in eastern Asia was the former empire of China. A few states independent of the British Empire still dotted the southern and western periphery of the continent: French Indo-China, Siam, and the outlying Arab possessions of the Ottoman Empire. In the late nineteenth and early twentieth centuries Russia had girded her far-flung possessions with bands of steel. After the war the question was asked: Would Great Britain also span her new "Middle Eastern Empire" with railways or the more recently developed motor roads?

It looked for a time as if this might be done, as if the dreams of the prewar generation of a "Calais-Calcutta express" might indeed be fulfilled by the railway alone or by some combination of railway and motor bus. Plans were in the air and surveyors were in the field working on future lines of communication from the Mediterranean to India. A great strategic route was in the making that would consolidate the British position in the Middle East, open a new artery for commerce and speed troops and supplies to and from the Middle East and India in times of emergency. It would protect and be protected by the air line above—together they would forge new "overland" links of unprecedented importance for the system of imperial communications.

During the war certain tentative steps were taken which though widely separated in time and space seemed to point to this unified goal. Certain railways had been built, certain negotiations conducted, and most important of all certain regions occupied. When peace came Great Britain was ensconced in Palestine, Mesopotamia, and Persia; short railway lines were completed in Palestine and Mesopotamia; and the Indian railway system extended within the borders of Persia. All of these developments were designed to facilitate the movement of British troops and supplies in the respective theaters of war. A standard gauge railway was completed from Kantara, on the Suez Canal, to Jerusalem and Haifa by 1919. By the same year the British in Mesopotamia had built lines from Basra to Baghdad (following the Euphrates valley); from Baghdad to Khanqin, near the Persian border on the road to Kermanshah; and from Baghdad north along the Tigris to the town of Sherghat. (In 1928 the track on the last mentioned line was taken up north of Baiji.) In 1916–17 the railhead of the Indian rail-

*"British Railways and Motor Roads in the Middle East 1930–1940" will appear in the next issue.

ways at Quetta in Baluchistan was extended west to the Persian town of Duzdap, about seventy miles within the Persian border. This line was known as the Nushki-Seistan extension. The first steps to join together these rudiments of a great transcontinental system were taken after the war in Persia where the political situation proved most immediately favorable. Unfortunately it was to prove a false dawn.

During the war virtually all of Persia had been occupied by British forces. This policy of domination was capped after the war by the conclusion in 1919 of a treaty with Persia establishing a virtual British protectorate. Persia was to take her place in a chain of vassal states stretching from the Mediterranean to India. The prime mover behind the Persian treaty was Lord Curzon. His motives have been beautifully expressed by Harold Nicolson in his brilliant biography: "Always he had dreamt of creating a chain of vassal states stretching from the Mediterranean to the Pamirs and protecting, not the Indian frontiers merely, but our communications with our further Empire. It seemed in those early months of 1919 that this dream was about to be realized and that Providence had vouchsafed to him, in the evening of his life, the privilege of conferring one final benefit upon the India which he had served so lovingly, although with such unthankful recompense." It is regrettable that the lofty idealism of Lord Curzon's imperialism was marred by the unfortunate way in which it was implemented. He made a number of tactical errors in the pursuance of his treaty policy which rendered it highly unpopular in Persia and among the other powers as well and caused it to have but a short-lived and miserable existence.

By the terms of the Agreement negotiated by Sir Percy Cox and signed on August 9, 1919, the British Government reiterated in the most categorical manner the undertakings they had repeatedly given in the past to respect absolutely the independence and integrity of Persia. In return for this assurance Persia agreed to accept British expert advisers "endowed with adequate powers," to receive British officers, munitions and equipment for her army, to revise her tariff, and to accept British coöperation in improving her communications "by means of railway construction and other forms of transport. . . ." To finance this program of reform Persia in a separate agreement borrowed £2,000,000 from Great Britain at seven per cent interest. Despite the bitter opposition which it aroused, the British treaty was at once implemented in its several aspects without awaiting the necessary ratification by the Persian Mejliss.

In the matter of developing Persian communications British imperial designs were respected by the subservient Persian Government. In the spring of 1920 the latter granted to a powerful British group (the Persian Railway Syndicate of pre-war days) the option on the proposed continuation of the Iraq railway from the Persian frontier to Teheran and apparently asked that the survey for the Muhammareh-Khurramabad railway (for which a two year option had been given in 1913) be continued from the point where it had been interrupted in 1914. When the Syndicate completed surveys of both railways the government would either grant it a concession or reimburse it for the surveys and build the railways itself if it seemed desirable to go ahead. Before the end of the year British surveyors were in the field. The results of their work were in due time reported.

There is no indication that the British Government wished more than the Teheran extension of the Iraq Railways in the immediate post-war period but the speedy fashion in which the survey for it followed upon the Anglo-Persian Agreement led to immediate and widespread speculation on its possible continuation to India. There were those in England, including *The Times*, who envisaged the future communications of Persia in terms of motor roads, but the great majority looked to the development of railways. It was generally felt that the Teheran railway and the Nushki-Seistan extension would meet at Meshed—the capital of Khorasan. Although the route to India would be greatly lengthened such a railway would tap the commerce of Khorasan and Seistan, and would extend British influence along the northern border of Persia encircling her like a "ring fence." *The Near East* wrote in 1919 that the junction of Khaniqin and Duzdap (i.e. the British railheads in eastern Iraq and eastern Persia) could "hardly be delayed indefinitely." A frequent contributor to the *Fortnightly Review* observed: "If the British remain in Mesopotamia they will most probably set about the construction of a trunk line eastward from Baghdad through Khanikin to Teheran, which in its turn will connect with a similar line from India, through Quetta, and then the 'Overland to India' will bring Calcutta within about ten days' distance of London." It was quite generally held in Europe that Great Britain was planning such a railway, and it was asserted, on what authority I am not aware, that a definite tracée was laid down from Duzdap to Meshed in 1919–20.

But these plans and the work of the Persian Railways Syndicate were rendered abortive by what one American critic, Professor Norman D. Harris, has stigmatized as the "short-sighted diplomacy, stupid blundering, and unpardonable delays" of the British Government in their dealings with Persia. The original suspicion of the Anglo-Persian Agreement only deepened as time went on. Within less than a year the premier who signed the agreement had lost his political backing and was forced to resign. Soon after some of the newly arrived British advisers began to return home, "apparently convinced that said treaty will never be accepted by the Persians." The chances of its ratification were dealt a mortal blow in February, 1921, by the conclusion of a Russo-Persian treaty in which the Bolsheviks cancelled Persia's debts and handed back all concessions, public works, railways, etc., granted to the czarist government. With the fall of Teheran on February 21 to the military party, led by the young cavalry officer, Reza Khan, all hope departed. The new premier, Sayyid Zia ud-Din, denounced the Agreement and in June Reza Khan spoke to the new Mejliss of its "happy demise." The withdrawal of British advisers and armed forces already under way was speeded up, the last troops departing in 1924.

Although the new nationalist government did not cancel the option of the Persian Railways Syndicate it was a foregone conclusion that this and other plans for the development of Persian communications under British auspices were now out of the question. The Persian representative to the First General Conference on Communications and Transit convened by the League of Nations in March and April, 1921, reported on the railways then under consideration in his country. Since the new government in Persia could hardly have formulated a transport policy in the space of two months his views are indicative of the policy of the old regime

and thus reveal what might have developed had the nationalist government not come into power. There were four railways which Persia was considering according to his report: 1) a railway from Muhammareh to Khurramabad, 2) the extension of the Julfa-Tabriz railway to Teheran, 3) the connection of Teheran with the Trans-Caspian system and 4) with the Baghdad railway. The first and fourth railways were clearly dictated by the desires of the British. In a more distant future, it added, the Paris-Peking railway and the line from Russia to India would also cross Persian territory. Speaking of motor transport it concluded significantly: "This means of transport is doubtless destined in a short time to attain a very considerable development, as the construction of railways is a very lengthy affair."

Despite the unfavorable circumstances the Persian Railways Syndicate submitted its reports on the surveys of the Khaniqin-Teheran and Muhammareh-Kurramabad railways. They were of course stillborn. In 1924 Reza Khan, by then premier, was reported to have said he regarded the concessions for these lines as both having lapsed. But the British government, in the face of an American demand for a Muhammareh-Teheran line, continued to uphold their validity. In 1923 one of the American advisers of the Reza Khan government proposed an extension of the Duzdap railway into Seistan for a distance of about 135 miles to tap the grain of that province and the wool and cotton of Khorasan. When the government took no action on this suggestion the Northwestern Railway of India offered to build the extension at its own expense, but the cautious Persian government was reported definitely to have refused the offer—wishing her railways to be entirely Persian in every sense. This was the last British attempt to extend its railways into Persia. Thereafter, with the future air line and other very substantial British investments in mind, she pursued on the whole a policy of extreme correctness toward Persia and attempted to avoid wounding Persian sensibilities, this rather unique behaviour being called forth by the self-denying policy of Soviet Russia. Despite these efforts, however, she could not resist asking for a privileged position in the matter of the air line and Persia remained essentially suspicious of British wooing. That England (and Russia) were only biding their time was clearly revealed by the military occupation of Persia in World War II.

At the same time that the British Government was negotiating a political treaty with Persia from which, among other things, they hoped to gain the opportunity of pushing forward an Indo-Mediterranean railway, they were carrying on discussions with France at the Paris Peace Conference designed to make it possible to construct the western end of the same trans-continental line entirely within British controlled territory. The espousal by Great Britain of plans for a Haifa-Baghdad railway presents at once the question: why did she not complete instead the former German Baghdad railway? The latter system was by January, 1919, entirely under British control; all that lacked to complete the line from the Bosporus to the Gulf was the section below Baghdad, already under construction, and a short link of about two hundred miles between Nisibin and Sherghat passing through the oil center of Mosul. The Baghdad railway could have been completed at a fraction of the cost of a Haifa-Baghdad railway and would have been commercially profitable over a much greater proportion of its length than a line cutting across the Syrian

desert through Tadmur. The explanation for the British decision is, of course, that the Haifa-Baghdad railway was dictated chiefly by strategic and political considerations rather than by cost or commercial future.

Before the war it was to Germany's advantage to unite Mesopotamia with the heart of the Ottoman Empire and so to open her to German commercial and political penetration. When Great Britain replaced Germany as protector of Turkish Arabia it was in her interests to separate Iraq from the remnant of the old, corrupt Ottoman Empire in Anatolia, to develop her resources through British channels of trade by way of the Mediterranean, the Persian Gulf and Persia, and to utilize her territory as a stepping stone for the new imperial routes to the East. The proposed Haifa-Baghdad railway was designed primarily to serve as a strategic route from the Mediterranean coast to the Persian Gulf under exclusive British control. Later, if the railway from Khaniqin to Duzdap materialized, this route would continue on through Persia proper to India and the East. In the second place the Haifa-Baghdad line was to serve as a commercial outlet for the products of Mesopotamia and Persia; and, thirdly, it was to facilitate the building of an all-British pipe-line from the oil fields of Mesopotamia to the Mediterranean, to aid in its protection, and in the protection of the aerodromes, emergency landing fields, and fuel dumps of the future air line to India.

Subsequent developments in the post-war Middle East only confirmed the wisdom of the British decision. The advent of a strong nationalist government in Turkey at sword's points with the British over the ownership of the rich and highly strategic province of Mosul made a railway from Iraq to Turkey out of the question. The British were in genuine dread of a Turkish invasion of Mosul which a railway would have facilitated; furthermore to have put the commercial outlet of Iraq in hostile Turkish hands would have been suicidal. Until the Mosul dispute was settled and amicable relations were established with Turkey any thought of completing the Baghdad railway was premature. The bitter rivalry between France and England in the Middle East and unsettled conditions in the French Syrian mandate worked in the same direction as the Baghdad railway passed for a short distance through Syria. Radical political readjustments were necessary before Great Britain consented in the 1930's to the completion of the last link in the former Berlin to Baghdad railway.

The negotiations for the British Haifa-Baghdad railway were intimately bound up with the Anglo-French settlement of their oil interests in Iraq and the distribution of the Class "A" mandates. The Sykes-Picot agreement had tentatively defined the future spheres of influence of the two powers in Turkish Arabia, had confirmed Great Britain in her possession of the Mosul oil concession, and had provided for a future British railway from Haifa to Baghdad. In the agreement Palestine was to be put under an international régime after the war; political control of Mosul province in northern Mesopotamia was to go to the French. French desire at the war's end for a share in the oil of Mosul led to important modifications of the Sykes-Picot agreement and opened the door to further bargaining for the railway. While visiting in England in December, 1918, Clemenceau presented the French demand for participation in the Mosul oil concession. Lloyd George requested in return that a British mandate be substituted in Palestine for an international administration and that

Mosul be transferred to the British sphere. The withdrawal of Russia from Armenia now made a French buffer in Mosul unnecessary; furthermore, Mosul was the keystone of Iraq's defense and the defense of the railway and pipeline. In February France agreed to Lloyd George's proposals on the further condition that the whole of Syria be treated as a unit and placed under a French mandate. France also acquiesced in a British mandate for Palestine.

The effect of this settlement on the railway was only partially to England's advantage. By securing control of Mosul and Palestine she was in a better position to protect it from attack by Turkey or a northern aggressor, but her recognition of the French position throughout Syria presented difficulties in the way of the route she wished it to follow. The French claimed the entire region down to Dera including the valley of the Yarmuk which flows into the River Jordan from the east just south of Lake Tiberias. The British wished to push the French boundary further north so they could run their railway up the Yarmuk valley and through the Jebel ed Druz to Tadmur without entering French territory. Negotiations over this issue continued throughout 1919 but the British failed to win their point. The French suggested that the British run their railway up the Wadi Zerka, to the south of Dra, and across the desert. Since no route was known across the desert south of Tadmur this proposal met with much skepticism, but Balfour was sufficiently impressed to have two reconnaissances carried out. Neither succeeded on account of Arab raids but the possibility of such a railway reconciled the British delegation to the boundaries finally agreed on.

Before this was accomplished an agreement in principle on the railway was reached in connection with the accord on Mosul oil. The Lloyd George-Clemenceau bargain had included two important points: 1) that France surrender Mosul in return for a share in its oil, and 2) that Great Britain support a political settlement in Turkey in which France's right to all of Syria be secured. The agreement on oil was reached without difficulty and was embodied in the San Remo Oil Agreement of April 25, 1920. France was to get 25 per cent of the net output of Mesopotamian crude and 25 per cent of any oil piped from the Anglo-Persian fields through French mandated territory. In return she agreed to the construction of two pipe-lines and "railways necessary for their construction and maintenance" from the oil fields to the Mediterranean. If it was necessary to run one or more of these pipe-lines and railways through Syria, France would give them every facility as to routes, construction, and port accommodations.

The political settlement was less easy, but in December an agreement was reached which defined the boundary between French Syria and British Palestine so as to give Great Britain railway access to Baghdad from Haifa. The British, in the manner mentioned earlier, had become reconciled to the French claim on the Yarmuk valley and the Jebel ed Druz. They gave up their plans for a railway through Tadmur in return for certain facilities on the existing Haifa-Damascus railway and the possibility of a parallel railway in British territory up the left side of the Yarmuk valley and from thence across the desert to Baghdad. Article 9, defining the southern boundary of Syria, provided that "la frontière laissera en principe la vallée du Yarmouk dans le territoire sous mandat français mais sera fixé aussi près que possible de la voie ferrée, de manière à permettre la

construction par la vallée du Yarbouk [sic] d'un chemin de fer entièrement situé sur le territoire sous mandat brittanique." (Convention concerning the mandates of Palestine, Mesopotamia, Syria, and Lebanon, signed at Paris, December 23, 1920, by France and Great Britain.)

Additional articles (5 and 6) made more specific provisions for the Haifa-Baghdad railway. By the terms of Article 1 the portion of the Hejaz Railway from Haifa to Lake Tiberias fell within the British mandate. In Article 5 France agreed to facilitate the use by Great Britain of that portion of the Hejaz railway east of Lake Tiberias to Nasib (south of Dera) which lay in French territory. Great Britain would thus have railway connection between Haifa and Amman in Trans-Jordan. France also granted Britain the right to build a pipe-line along the railway and to send troops over it at any time. These provisions were designed to be essentially temporary, however. For France further consented to the appointment within ten years of a special Anglo-French commission to study and adjust the boundary in the valley of the Yarmuk as far as Nasib to make possible the construction of a British railway and pipe-line joining Palestine with the Euphrates valley and passing entirely in the British mandate. If Great Britain exercised her right to call for this readjustment she was to lose her privileges on the French railway when her own railway was completed. Article 6 stipulated that the facilities granted by France implied the maintenance of the San Remo Oil Agreement ceding her rights in Iraq oil.

The way was now clear for the execution of Great Britain's cherished plans for a strategic railway from Haifa to Baghdad. A survey party had been sent into the Syrian desert in the spring of 1920, even before the agreements were signed and simultaneously with the initiation of surveys for the extension from Khaniqin to Teheran. It looked in 1920 as if the railway to Teheran was a matter of the very immediate future.

The leader of the survey party in the desert was Major A. L. Holt, a railway engineer. He had been sent out to make a reconnaissance of the desert in connection with the establishment of the R.A.F. service route from Cairo to Baghdad but in the course of this work he also made surveys with a view to discovering the best possible alignment for a railway from Baghdad to the Mediterranean. As the British Government reported to the League: "The data acquired [from the R.A.F. reconnaissance] was of great value to the administration in connection with the projected Baghdad-Haifa railway." Major Holt was in the field intermittently from 1920 to 1922. He confined his attention chiefly to the route Baghdad-Hit-Rutba-Azrak-Samrah (about 22 miles north of Amman on the Hejaz Railway). West of Samrah the railway would presumably descend the Yarmuk valley and join the branch of the Hejaz railway running to Haifa. In 1922 Holt joined Mr. Philby, the British Resident in Trans-Jordan, on a mission to the Jebel Anaza and briefly surveyed the ground from Amman to Jauf down the Wadi Sirhan. This route was dictated by strategic considerations as further removed from the French and Turks but it was found on examination that it would not be advantageous for a railway. The other alignment on the contrary was found quite feasible with few difficulties from the engineering point of view.

Major Holt became an ardent advocate of the railway he had surveyed and called down upon himself the remark of Lord Ronaldshay that railway engineers

as a sect were born with an undue share of optimism. In lectures before the Royal Geographical Society and the Central Asian Society he elaborated on his survey work and the advantages which the railway would bring to the British Empire. Its principal purpose, he explained, was the development of the trade of Mesopotamia and "the shortening of the journey to India through Persia." It will be the cheapest journey from the East to the Mediterranean . . ." and will make Baghdad more than ever the clearing house for Persian trade, he added. The weakness of the airplane was its inability to carry heavy loads great distances at a price competitive with ground transport. "Thus," he reasoned, "the present growing demand for a shorter route from Persia and Baghdad to the Mediterranean can only be met by a railway across the desert." It would reduce the present twenty-seven day sea journey from London to Baghdad by nearly a fortnight. Holt, quite patently, was absorbed in the commercial possibilities of the railway.

Had the Haifa-Baghdad railway been completed in conjunction with the Khaniqin-Teheran extension, as was clearly anticipated in 1920, almost precisely half of the rail connection between the Mediterranean and Duzdap via Meshed would have been called into existence. Both commercially and strategically its importance for the British Empire would have been very great even had the Teheran-Duzdap link been indefinitely postponed. It would have paved the way for British political and commercial hegemony in the entire Middle Eastern chain of states and would thus have contributed to the safety of both the Suez route and the new air route to India as well as serving itself as an auxiliary line of communication as far as it went. But the Haifa-Baghdad railway and its Persian extension were never begun—the latter for political reasons, the former on these and financial grounds as well. Warfare among the Arabs and border raids into the British mandates must have been a strong deterrent. The theoretical lines of the mandate boundaries had not yet been worked out in treaty form with the Arabs. But the deciding factor was undoubtedly the necessity for economy created by the post-war depression in Great Britain. The government was continually heckled in Parliament about the expense of the Middle Eastern empire. This had led to the calling of the Cairo Conference and the decision to enter into treaty relations with Iraq in lieu of a mandate. The abandonment of extensive and expensive plans for railway development was part of this policy of retrenchment.

Fortunately for the empire the growing economic revival in the Middle East called forth a new form of trans-desert communication which as time went on came more and more to fulfill the function of a railway and threatened to push the probability of one being built into a distant future. The motor car was developed during and after the way to a point where the desert ceased to be a barrier. German military trucks were the first to cross the desert, from Aleppo to Mosul and Baghdad, during the war. They were built for hard roads, however, and were not of much significance for military transport purposes in Iraq. The English provided the Hejaz Bedouins attacking the Turks with light trucks with broad tires which were much more successful than the German in desert warfare. When peace came Major Holt used the Model T Ford with outstanding success in his desert surveys. Beginning in the same year, 1920, Syrian drivers, attracted by high rates and even more by the

advantages of the contraband trade, began to drive across the desert on commercial ventures. When the economic revival in the Middle East began to express itself in an increased traffic of goods and passengers with Europe special incentives presented themselves for improving on the slow, circuitous and costly route from Iraq and Persia to Europe by sea.

Credit for the conception of a regular motor transport service between the Mediterranean and Baghdad must unquestionably go to Mr. C. E. S. Palmer, H. M. G. Consul in Damascus. Although privately arrived at, his plans soon took on a semi-official character, and the development of the trans-desert motor route though not actually promoted by the British government received from the start its open approval. It was not many months before it had created an indispensable niche for itself in the system of imperial communications. Early in 1923 Palmer began to investigate the possibility of a quick route for cars from Damascus to Baghdad. He made the acquaintance of a wealthy Baghdad merchant whose cars had made several successful trans-desert trips smuggling gold out of Syria into Iraq. Together they arranged a trial trip. The consent of the British Foreign Office and Air Ministry was secured and Major D. McCallum, a British liaison officer at Beirut, was instructed by the government to make a detailed report on the results of the reconnaissance. Palmer's project thus received official sanction almost from the start. Mr. Norman Nairn, owner and operator of a motor service in Palestine, was persuaded to lend the necessary automobiles, drivers and mechanics.

The trial trip was run in April, 1923, from Damascus to Baghdad in three days without incident. Mr. Palmer and Major McCallum were convinced of the feasibility of establishing a motor route along the track they had made. Various government and other officials in Baghdad were enthusiastic. In particular Major Douglas Gumbly, Postmaster General of the Iraq government, became keenly interested in its possibilities for the carriage of mails. Actually it was at his request that Mr. Nairn organized the desert service. Nairn was quick to realize the potentialities of the situation himself and during the spring and summer of 1923 organized five more survey trips across the desert. From this point on, the development of the route was chiefly due to his initiative and enterprise.

During the war Norman Nairn and his brother Gerald had come from New Zealand to serve in the English auto formation under Allenby in the Palestine campaign. There they collected experience and saw the crying need for motor transport in the Middle East. When the armistice came they stayed on in Palestine and built up a motor business employing only "ex-officers who were on their beam ends." At first they sold cars on commission and ran the usual hire business. Later they extended their business to Egypt where cotton was booming; but in 1922 cotton broke and they had to look for openings elsewhere. It was at this juncture that the possibility of extending their local bus service across the Syrian desert presented itself.

The five trial trips carried out over different routes in 1923 convinced the Nairns that the original track from Damascus to Ramadi through Rutba was the best fitted for motor service. There were no engineering obstacles; no grading or bridge building was required. It was decided not to run the route over the more direct and British course through Trans-Jordan due to the obstacle presented by the lava belt and

the fact that Beirut had a better harbor than either Haifa or Jaffa. By late summer of 1923 the Nairns, being satisfied with the reliability of the desert crossing, tendered for the delivery of mails between Haifa and Baghdad. A five year contract was accordingly granted them by the Iraq Government under which they were bound to deliver the mails between Baghdad and Port Said within sixty hours, the service to be weekly. From Port Said to Haifa the mails went by rail. The Nairn buses carried them from Haifa to Baghdad. With the opening of this Overland Mail Service the Haifa-Kantara Railway became an essential link in imperial communications and fulfilled the role that would have been assigned to it had the Haifa-Baghdad Railway been built as planned for after 1916. They also received the help and encouragement of General Weygand, with a concession for carrying Syrian mails similar to that granted by Iraq. According to an announcement of the Postmaster General of Great Britain in 1923 this "Overland Mail Service" was to connect with the Indian mails leaving London every Thursday via Marseilles and Port Said. It was available for all mail except parcels, for Iraq and the Persian Gulf. Mail leaving London on Thursday would reach Port Said on Wednesday, Haifa on Thursday, and Baghdad on Saturday night—a total of nine as compared with twenty-four days by sea. The first mail by the new route was dispatched from London on November 22, though the Nairns had opened regular mail service in October. The new service was much cheaper than the air, ran twice as often and was just as fast and more reliable. It was indeed an epoch-making development.

The benefits of the new trans-desert service were opened from the outset to travellers. The Nairn Transport Co. agreed to carry passengers on the route from Haifa to Damascus via Beirut. This business increased by leaps and bounds. In 1925 they were running eight or nine cars in the weekly convoy instead of the original two. In 1923 arrangements were made with the Compagnie des Messageries Maritimes for through bookings from London to Baghdad at a rate of £70. The whole journey occupied about ten days. In 1924 the British Government reported to the League: "The service is now a well-established, regular and reliable institution. . . ."

In 1926 a short-lived attempt was made to extend the Nairn service to Teheran. The possibility of continuing clear on to India had immediately occurred to onlookers when the original route was opened. A native Syrian company, moreover, had organized a rival line from Beirut to Baghdad via Tadmur in 1923 and in 1924 had begun a regular fortnightly service on to Teheran. By a contract with the Shah it obtained the rights of transport on Persian roads. But the company fared poorly from the start and shortly before its amalgamation with the Nairn Transport Co. in September, 1926, Nairn took over the Teheran business. They carried passengers and the British legation mails once every fortnight, going to Khaniqin by rail and on to Teheran by bus. But by the end of the year they too had to abandon the route to Persia. In 1925–26 during the Druze rebellion in Syria the Nairn desert convoys were re-routed from Rutba through Trans-Jordan to Jerusalem. "This is the route which Iraq, Trans-Jordan, and Palestine and the British are reported to favor," said an American consul. But it was uncomfortably rough and hard on cars. In 1926 it was abandoned in favor of the original track.

In the same year a significant re-

organization of the Nairn Transport Company was effected and it was sold "for both financial and political reasons" to a group of Anglo-French financiers. Its chief rival had always been the Eastern Transport Company, mentioned above, which had been founded by a Syrian of Palestinian origin less than five months after the Nairn concern had initiated the desert route. In 1926 it went bankrupt and was amalgamated with the English firm. On September 20, 1926, the Nairn Eastern Transport Company was founded with a British chairman resident in London. Norman Nairn remained managing director. Ownership of the new organization passed into the hands of a group of English and French banks, business firms and individuals. The chief English shareholders were the Anglo-Persian Oil Company, the Ottoman Bank, the Imperial Bank of Persia, and Stern Brothers of London. The French concerns most interested included La Banque de Paris et des Pays-Bas, La Banque Ottomane, Le Crédit Foncier d'Algérie, and the Messageries Maritimes, Ltd. The largest single block of shares was held by the Anglo-Persian Oil Co. in which the British government had a controlling interest. Mr. Norman Nairn retained almost one-half of the privately owned shares. It is clear from the character of this reorganization that England and France had pooled their interest in the trans-desert motor service. Where formerly there had been two competing, privately-owned firms interested in the trans-desert route there was now but one the ultimate control of which had apparently passed into the hands of the British Government. By their action the British Government gave tacit recognition to the fact that the overland route had become an important imperial line of communication between the Mediterranean and its hinterland even unto India.

In the years that followed the volume of traffic greatly increased. Despite the Persian policy of restricting imports and diverting them from the Iraq route the transit trade continued to grow. As the appointments became more luxurious and the route more widely known in England and Europe more and more travellers to and from India utilized its saving in time. The *Palestine Weekly* published some interesting statistics for 1927. Syria exported to Persia in that year over 43,000 kg. of goods, to Iraq over 2,000,000 kg. From the former she imported 6,000,000 kg. and from the latter 1,300,000 kg. The total value of this trade was estimated at 89,400,000 francs. The "Overland Mail" carried 4,564 bags of mail. All in all 3,892 autos and 19,982 passengers crossed the desert. This was a phenomenal growth in the space of four years. The loss of the mail contract in 1928 to an Iraq firm caused but a slight setback.

The significance of the new overland route was immediately realized and has often been commented upon. *The Near East* in 1923 hailed it as "an important development" and pointed out that "it opens up very wide possibilities as an important link in Imperial communications," and should be extended to Teheran and other points in Persia. In a *Special Report* to the League on Iraq in 1931 the British Government said that thanks to this new means of communication there were hopeful signs that Persian trade was being re-oriented towards the Mediterranean even in the face of Persian government restrictions. His Highness the Aga Khan summed up the significance of motor transport on this route for the Middle East in these words: "Motor transport, for which there is an abundance of petrol in Iraq, Persia and Arabia, has made it possible

not only to develop these regions, but once more to bring commercial prosperity to their most remote parts. . . . Undoubtedly the overland route to the East is coming into its own again, linking up Europe with the densely populated countries of Eastern and Southern Asia by a cheap and rapid form of transport." Its wider implications were stated boldly by Professor Toynbee in the *Survey* for 1934: "The effective opening-up, for the first time in history, of the direct trans-desert route between Iraq and the Mediterranean coast of Syria was one of the most important developments in world-communications in the post-war age. . . ."

The Iraq Railways constituted the nucleus of all existing and proposed British land routes through the Middle East of the World War I. During the 1920's they led a moribund existence; uncertainty as to whether their ownership would remain with Great Britain or pass to the Iraq government delayed urgently needed improvements and acted as a check on plans for their extension to the Mediterranean or the north. On April 1, 1920 they were handed over by the British military authorities, by whom they had been constructed, to the British Civil Administration. But they proved to be a white elephant. They had been laid down in great haste on poorly built roadbeds and with extremely inadequate bridges. Considerable expense was required to keep them open even to very slow traffic and yet, with the notable exception of the Baghdad-Basra section, they were running at a loss. Neither the British nor the Iraq Government wished to spend money on repairs or further development. Yet these were absolutely essential before they could expect to draw sufficient trade to run at a profit.

When the British Government adopted the treaty policy toward Iraq in 1921 it also determined to transfer ownership of the Iraq Railways to the government of Iraq. As a preliminary measure the Financial Agreement concluded in accordance with the Anglo-Iraq treaty of alliance provided that as of April 1, 1923 the management and administration of the railways was to be transferred to Iraq. Four years after ratification of this agreement ownership of the railways would in turn be handed over to Iraq on terms to be mutually agreed on. Despite persistent attempts no agreement had been reached by the time set, nor when Iraq was ready in 1932 to establish herself as an independent state.

The Hilton Young-Vernon investigation into the financial position of the Iraq Government in 1925 resulted in a suggested solution of the railway problem which formed the core of later proposals for their transfer. In order that capital might be raised to make the needed improvements in the railways that would enable them to modernize and meet competition they recommended that their ownership be transferred to a corporation capitalized at 500 laks (50,000,000 rupees; £3,850,000) —the stock to be held equally by the British Government and the Iraq Government and the latter to have the option to buy out the former's shares at par. The Board of the Corporation should consist of five members, three appointed by Iraq and two by Great Britain. During the treaty period the General Manager should be subject to the approval of the British Directors. This scheme of reorganization, they concluded, would remove obscurities and unrealities and would put the railways in a better position to borrow. These recommendations were endorsed in 1928 by Brigadier-General Hammond in his special report on the Iraq Railways, with the slight exception that he sug-

gested the Board consist of two persons appointed by Iraq, two by Britain, and the Director of Railways who would be ex-officio chairman and whose appointment would be subject to approval by both governments.

Despite the appearance of these well-considered recommendations Iraq and Great Britain were unable to reach a solution by the time agreed on in 1928. Iraq was reported willing to take over the railways on certain terms the chief of these being the right to decide which of the British officials should come with the transfer and the terms of their future appointment. Two years later Great Britain and Iraq concluded a treaty to govern their relations when the latter should be recognized by the League as independent. In notes appended to the treaty it was agreed that all outstanding financial questions such as those relating to the transfer of the Iraq Railways should form the subject of a separate agreement to be concluded as soon as possible and ratified simultaneously with the treaty. This was of course no solution of the problem. The treaty was ratified in January 1931, but it was five more years before a settlement was reached in the railway dispute.

In spite of the haze of uncertainty which surrounded the future ownership of the Iraq Railways there were two or three developments of some significance for British imperial communications. The first of these was the extension of the metre gauge line to Kirkuk. In 1920 two branches of the Iraq Railways pointed north toward the province of Mosul. A standard gauge line built in haste through virtually uninhabited country extended to Sherghat on the west bank of the Tigris but seventy miles south of the town of Mosul. The metre gauge line to Persia ran northeast from Baghdad and a branch might be run from it (at Kizil Robat) to Mosul by way of Kirkuk. By 1923 about thirty miles of this extension had been laid to the town of Kingerban. It was possible to follow either of these two routes for the purpose of linking Iraq's important northern province with Baghdad. The High Commissioner in his *Report* for 1922–23 favored the Kirkuk line because there was greater promise that the railway would tap local trade in addition to the grain exports and passenger traffic from Mosul.

Since the criterion for selection was its local commercial prospects, not a short connection with the railways of Anatolia and Europe, it was decided in April, 1924, to extend the metre gauge railway to Kirkuk as a preliminary to the connection with Mosul. A survey had been carried out in the preceding winter. Work proceeded at once on the seventy-mile stretch north of Kingerban, financed by a loan of 2,400,000 rupees from the Iraq Government. In the fall of the following year the line was opened for traffic to Kirkuk. The continuation on to Mosul although recommended in the Hammond report has never been completed. For a time in the 1930's, when the decision was taken to complete the missing link in the former Baghdad railway system and the choice lay between this line and its alternative up the Tigris, there was a possibility that this might be done. But it was ultimately decided to continue the Tigris railway instead.

In 1930, however, the Kirkuk extension did become part of an express railbus service between London and Basra. The first step in the formation of this new passenger route from England to India was the initiation of through services on the Anatolian railway from Aleppo to Constantinople in May, 1927. Connecting with the famous Simplon-

Orient express at Haidar Pasha a bi-weekly train de luxe with sleeping cars was run to Aleppo. It was announced at the time that an airplane service would be run in conjunction from Aleppo to Baghdad to connect with the existing Baghdad-Basra air route. So far as I am aware this was never carried out; but passengers could continue by train to Beirut or Damascus and cross the desert by bus.

In 1928 the Aleppo-Beirut section was speeded up in connection with the inauguration of express passenger service between Aleppo and Cairo. There had been serious talk in 1923–24 of a Tripolis-Haifa railway to complete a Calais to Cairo route but it had never eventuated. In 1928, as an extension of the Orient express route to Aleppo, a regular bus service from Tripolis to Haifa was organized to run in conjunction with the services of the Anatolian and the Palestine railways. This Simplon-Orient route from Calais to Cairo was opened on October 1, 1928, as an eight-day service from England to Egypt. The whole journey with the exception of the Tripolis-Haifa bus link could be made by Pullman, with dining car and bath as far east as Tripolis. It was a development of considerable significance for rapid passenger communication between Europe and Iraq as well as between Europe and Egypt.

Soon thereafter in 1929 negotiations were initiated for the completion of a shorter Simplon-Orient route to Baghdad than that via Aleppo and Damascus. A conference of railway men from Turkey, Iraq, Syria, and Kurdestan met at Haidar Pasha in April to discuss an express rail and bus service between England, Turkey, and Iraq. In the following January the new route was opened. Passengers in future travelled from Calais to Constantinople on the Simplon-Orient Express, mounted the Taurus Express across the Bosporus which took them to Aleppo, where the Iraq branch turned off to Nisibin. From Nisibin to Kirkuk they crossed the desert by bus, spending the night at a hostel in Mosul; beyond Kirkuk they rode on the Iraq Railways to Baghdad, Khaniqin, or Basra. From Basra they could proceed by air or steamer to India. The Taurus express to Aleppo ran thrice weekly, the Iraq branch twice a week. A Syrian branch to Beirut handled passengers destined for Syria, Palestine, Trans-Jordan and Egypt. The new express route to Iraq, Persia and the East filled a real need and proved increasingly popular with passengers passing between those countries and Europe. To a certain extent it replaced the Nairn trans-desert service, but the two were complementary to each other. It was more subject to political interference by foreign powers but until it was replaced by the completed railway to Baghdad in 1940 it served as an important supplementary route to the East.

LAND UTILIZATION IN THE MIDDLE GRAND RIVER VALLEY OF WESTERN ONTARIO

Chun-fen Lee

THE Grand River drainage system is the largest of those which radiate from the interior uplands of the southwestern peninsula of Ontario. Its area of about 2,610 square miles occupies the southeastern portion of the peninsula. It is irregular in shape, both its upper and lower portions being quite narrow, while the broad middle part of the valley comprises most of its area. It includes the counties of Brant and Waterloo together with the adjoining portions of Wellington, Oxford, Perth, Wentworth, and Halton.

The Grand River Valley slopes gently, though somewhat irregularly, toward the south, falling from an elevation of about 1,700 feet in the neighborhood of the source to less than 600 feet near the outlet of the river. In both the upper and lower portions of the drainage basin, there is very little local relief, while in the central portion it is rolling to hilly with a relief of 100 to 200 feet. The greatest degree of local relief is found in the areas of recessional moraines.

Surface Features

The entire region has been glaciated and the bedrock is covered by a variable thickness of glacial drift which controls the topography. The surface forms comprise an assemblage of glacial, glaciofluvial, and lacustrine deposits. Generally speaking, the region may be designated as a drift plain. The debris, spread over this plain by the ice, came from far and near, but much the larger portion is of local origin. For more detailed consideration, the surface features of this region may be classified as till plains, recessional moraines, glaciofluvial plains, and lacustrine plains. Each of these constitutes a rather definite association of land form and geological materials (Figure 2).

Till Plains.—The till in this region seems chiefly to have been deposited by the Ontario-Erie ice lobe. Upon this very widely distributed foundation, other forms of drift came to rest in many localities. In the northern half of the region it assumes a broad and almost unbroken extent, its eastern margin marked by the strong Paris and Galt recessional moraines.

Drumlins are among the most interesting structures associated with the till plains. Very well-defined forms occur between Everton and Guelph. With their axes, in general, running southeast to northwest, parallel to the direction of the flow of ice in the lobes they are from one quarter to a mile in length with heights varying from 25 to more than 75 feet. They are located in front of, between, and to the rear of the Paris and Galt recessional moraines, indicating that there were strong thrusts of ice toward the north chiefly from the basin of Lake Ontario, followed by periods of stagnation during which the drumlins were exposed. In some places the moulded forms of drumlins and the haphazard topography of the morainic ridges are in very close association.

Recessional Moraines.—Of the several

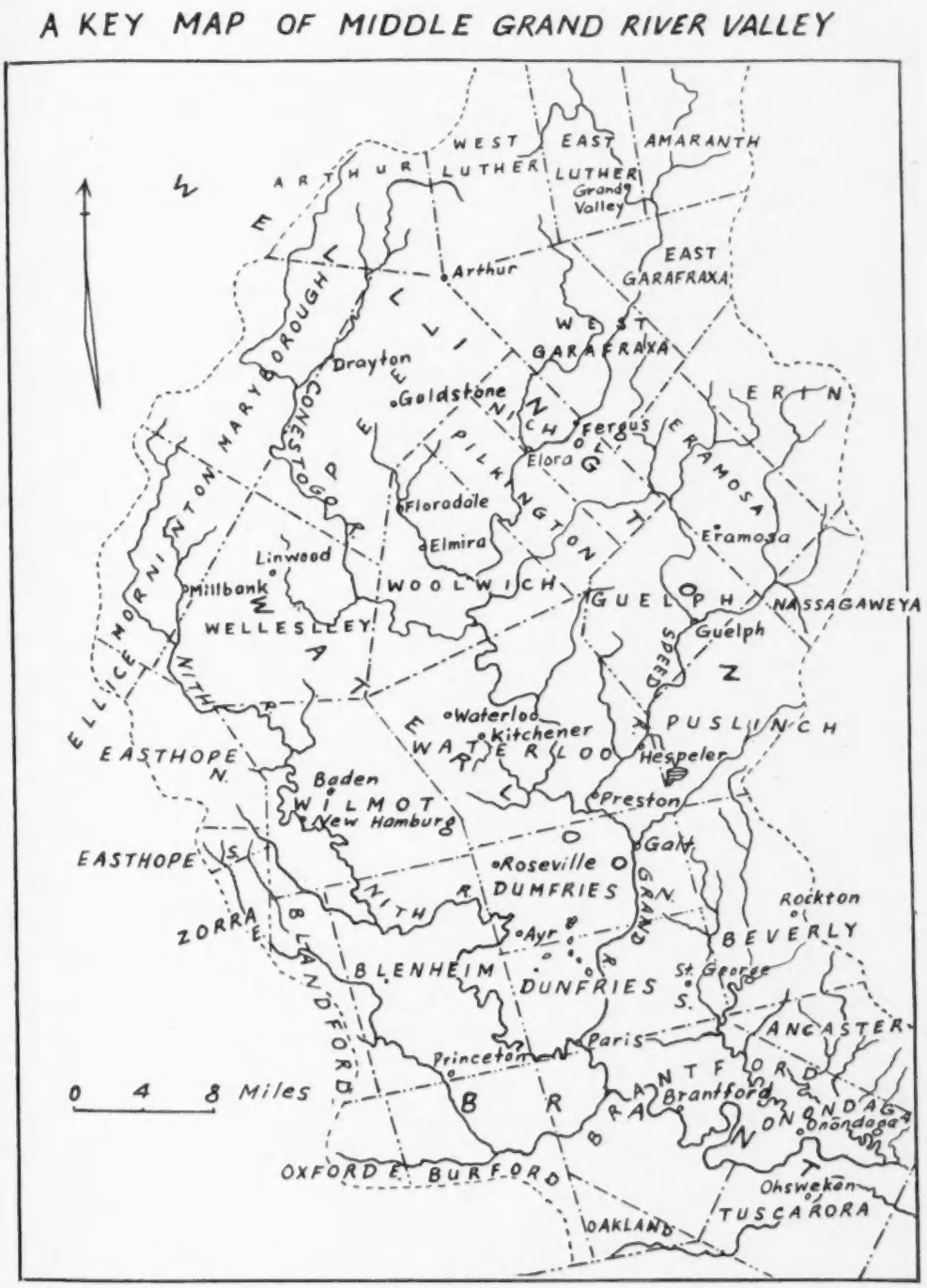

FIGURE 1.—Key Map of the Middle Grand River Valley.

recessional moraines in this region, the Paris and Galt strands are most strongly developed. North of Paris and Brantford they were land-laid while to the south they were built along a submerged ice front. The material of which they

are composed is usually unassorted and may be classed as till although less compact than that of the ground moraine or till plains.

Glacio-fluvial Deposits.—Features under this heading include kames, eskers, outwash plains, terraces, etc. Kames are usually associated with the margins of the recessional moraines, although occasionally isolated gravelly hills are found on the till plains. On the other hand, the long, sinuous, sandy or gravelly esker ridges show their best development on the open till plains or among the associated drumlins. Outwash plains and terraces are found in close association with the recessional moraines. During the melting of the ice a great deal of water drained southward along the ice front. Broad deep through valleys in front of and between the morainal strands and deep and sharply bordered gravel terraces give evidence of the tremendous erosive force and carrying power of this ancient river system. The Grand River, despite its history of disastrous floods, is but a feeble heir to the fluvial kingdom of its Pleistocene forerunner.

Although constituting an extremely interesting assemblage of physiographic features, this train of water-laid deposits cannot be segregated from the standpoint of land utilization owing to their close association with the adjoining areas of morainic land forms.

South of Paris and Brantford the ancient streams debouched into the pro-glacial lake which occupied the Erie depression and here are found immense sandy and gravelly deltaic deposits.

Lacustrine Plains.—Most of the sand was brought down by the meltwater streams while the ice stood at the moraines, consequently, the sandy deltaic plains are found toward the south and west and largely beyond the present Grand River basin. As the ice front retreated toward the northeast, however, all the Lower Grand Valley came under the waters of Lake Warren and extensive deposits of silt and clay are found.

In the western margin of our region, we also find a veneer of clay overlying the ground moraine, indicating the former presence of a lake in this area.

CLIMATE AND NATURAL VEGETATION

This region has a latitudinal extent from 42 degrees 50 minutes N. to 44 degrees 13 minutes N. and like the whole of the Ontario peninsula, it lies in the path of the westerlies and the accompanying cyclonic storms. As a matter of fact, the majority of the cyclones which cross the continent of North America tend to leave by way of the Great Lakes and St. Lawrence regions. D. F. Putnam and L. J. Chapman have classified southern On-

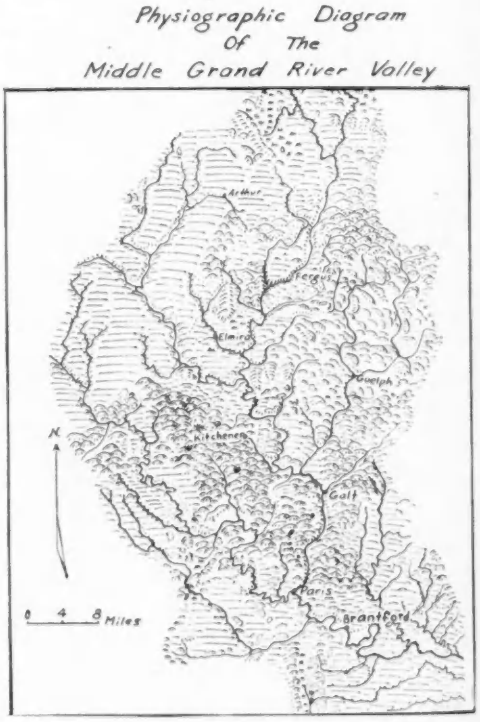

FIGURE 2.—Physiographic Diagram of the Middle Grand River Valley.

tario into fifteen minor climatic regions, three of which cross the Grand River Valley (Figure 3). The three stations for which temperature and rainfall graphs are shown (Figures 4, 5, 6) may be taken as typical of the three sections of the valley. The mean annual temperature is 43 degrees F. in the north and 46 degrees F. in the south, but the seasonal variation is pronounced. Winters are cold, summers warm, while spring and autumn are seasons of moderately rapid transition. The lowest temperatures occur in February (–40 degrees F. has been recorded in the northern part of the valley) and the highest in July (occasionally 100 degrees F. is recorded). The chief basis of differentiation, however, lies in the length of growing season and the occurrence of spring and autumn frosts. In the north the average frost-free period is 126 days while in the south it is 154 days. The growing season (based on a mean temperature of 42 degrees F.) varies from 189 days in the north to 203 days in the south. These variations have considerable effect upon the varieties of crops grown in the area.

The mean annual precipitation varies from about 30 inches in the east to 36 inches in the west and is fairly evenly distributed throughout the year. There is, however, a tendency for damaging droughts to occur occasionally during the growing season. Much of the winter precipitation falls as snow, particularly in the northern part of the valley which receives over 100 inches per year on the average and as a rule is covered by a continuous snow blanket from December to March. The southern portion of the valley, on the other hand gets about 50 to 60 inches of snow and the snow blanket is frequently removed by midwinter thaws.

According to the classification of Halliday there are two forest types to be found in this region. The northern part of the valley, owing to its higher elevation, ranging from 1,000 to 1,600 feet above sea level, lies in the Great Lakes-St. Lawrence Forest District. The dominant association here is one of broad-leaved trees, the prevailing ones being sugar maple and beech. In the original forest, white pine was common especially upon the lighter soils while toward the north white spruce may also sometimes be seen. Swamps and seepage areas support thickets of white cedar. The area south of Paris lies in the Deciduous Forest Region. There are associations here containing many broad-leaved species not found in the north. Maple and beech are common on the uplands. White, black, red, and pin oaks are found with them. Wild black cherry is found, especially on loamy soils; while elms, hickories, and white ash prefer the clays. Other southern species include walnut, chestnut and less frequently sassafras, magnolia, and tulip tree.

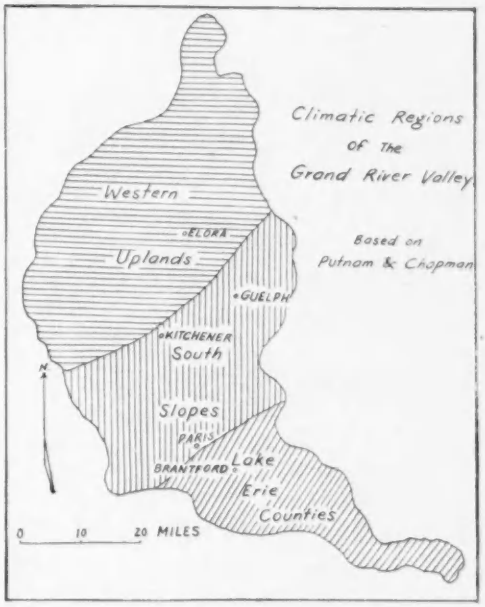

FIGURE 3.—Climatic Regions of the Grand River Valley.

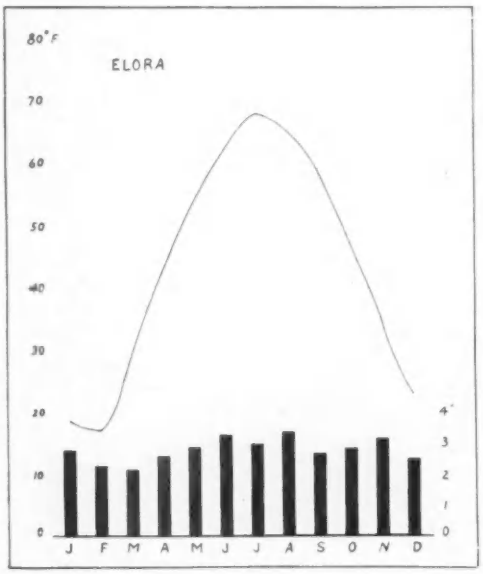

FIGURE 4.—Monthly Mean Temperatures and Precipitation—Elora.

Because of the complete agricultural occupation of the valley there are now no remaining virgin forest areas. The natural forest cover is confined to farm woodlots and hedgerows where it has been greatly modified by selective cutting and often also by grazing. On the whole, there is little upland forest left but many of the swampy valleys have not been cleared.

LAND TYPES

The correlation of agriculture with its physical environment demands that some sort of areal classification be used. The agricultural scientist in his search for a unit to express the function of land in crop growth has developed the soil type and many agronomists are now working in terms of soil types and crop varieties. For the purpose of the agricultural geographer, however, this is usually much too detailed a process. Farms as a rule have several soil types and it is the pattern which determines land use to a considerable degree. This was recognized some years ago by J. O. Veach who postulated that land of varying potentials for production might be segregated on the basis of the natural land type which he defines thus: "The natural land types consist of various combinations of the soil types and configuration features such as hills, basins, lakes, swamps, and the proportion of various slope classes." In other words they are patterns of surface features and correspond very closely to physiographic divisions. Within these, Veach made further separations of minor units or land types to which he gave geographic names. Somewhat similar work has been done in Ontario by L. J. Chapman and D. F. Putnam.

No detailed soil maps have been published for the area under study, but field surveys have been made for part of it and the manuscript maps and soil descriptions were made available by Mr. F. F. Morwick of the Ontario Agricultural College at Guelph. The region lies in the zone of the Grey-Brown Podzolic Soils and well-developed mature profiles are found in well-drained loca-

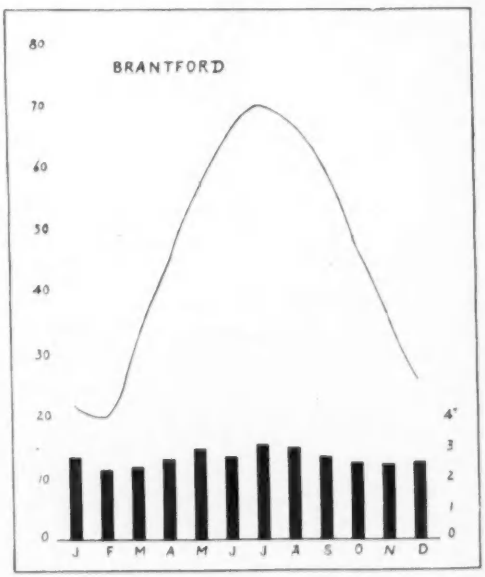

FIGURE 5.—Monthly Mean Temperatures and Precipitation—Brantford.

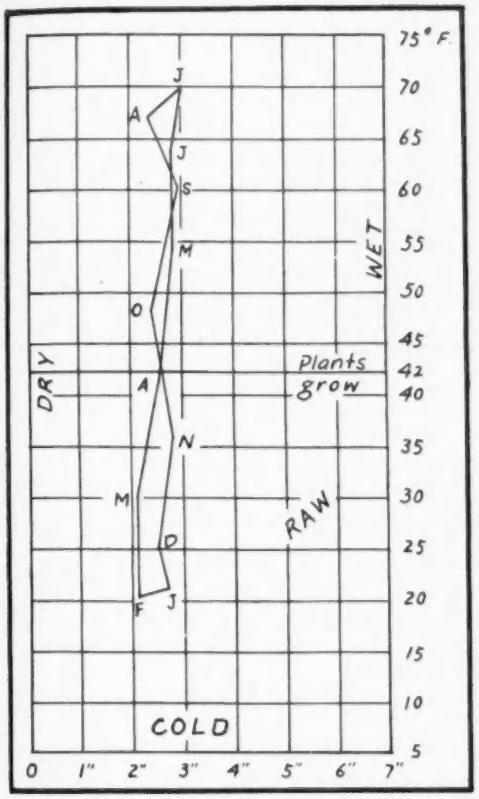

FIGURE 6.—Hythergraph of Kitchener. (At 42 degrees F. plants begin to grow.)

tions. As in most glaciated regions, however, there are numerous poorly drained areas containing intrazonal soils.

On the basis of land form, supplemented wherever possible by soil survey information, the Grand River Valley has been classified into ten land types, the descriptions of which are given in the following paragraphs (Figure 7).

TABLE I

LAND CLASSIFICATION IN THE GRAND RIVER VALLEY

I. TILL PLAINS. Land surface characterized by deposits of unassorted glacial boulder clay or till.
- (a) Arthur Land Type. Gently undulating northern part of region characterized by shallow to moderately deep calcareous till.....1
- (b) Oxford Land Type. Gently rolling, well-drained deep clay till in southwestern part of region.....2
- (c) Guelph Land Type. East-central part of region, rolling, drumlinized till plain, cut by numerous abandoned spillways.....3

II. RECESSIONAL MORAINES. Land surface characterized by rather heterogenous glacial debris, usually arranged in long belts and ridges. Includes also the closely associated spillways.
- (a) Paris Land Type. Surface deposits consisting largely of unassorted and often coarse-textured till.....4
- (b) Waterloo Land Type. Hilly land characterized by coarsely and irrregularly stratified sandy deposits overlying boulder clay.....5

III. LACUSTRINE PLAINS. Characterized by smooth surfaces upon more or less horizontally-bedded, water sorted materials.
- (a) Burford Land Type. Sandy and gravelly deltaic plains.....6
- (b) Perth Land Type. Extreme western part of region with shallow veneer of clay over till...7
- (c) Zorra Land Type. Southwestern part of region, characterized by shallow loamy deposits over till.....8
- (d) Haldimand Land Type. Extreme southeastern part of valley, characterized by fairly deep, stratified clay deposits.....9

IV. ROCK PLAINS. Characterized by shallow drift deposits over nearly horizontally-bedded rock.
- (a) Rockton Land Type. Eastern margin of the area, underlain by dolomitic limestones....10

(*1*) *Arthur Land Type.*—The Arthur land type comprises a large area of till plain in the upland region of western Ontario, including the northern portion of the Grand River Valley. The surface is characteristically undulating, consisting of very broad low swells and broad swales. The soils are loams and clay loams developed upon calcareous materials. The clay content tends to increase toward the southwest and some level stretches of clay plains occur, while there is a greater diversity of relief, due in part to the action of the Grand River and its tributaries, than is found in some of the lake plains farther south; there is also a greater proportion of poorly drained land and of undrained peat and muck associated, particularly toward the north. Many of the poorly drained areas were cleared but abandoned for cultivation and have grown up with willow bushes. Discounting the "willow flats," however, the agricultural value of the uplands is fairly high. Erosion is a problem only along the sides of the stream valleys (Figure 8).

(*2*) *Oxford Land Type.*—This land type is found on the undulating to gently rolling till plains of the southwestern portion of the region. It is intermediate both in position and in degree of relief between the sandy

morainic hills of the Waterloo land type and the flattish clay plain of the Zorra land type to the southwest. Drainage conditions are good and well developed. Grey-Brown Forest soils which have been classified as belonging to the Guelph series occur on the uplands The texture of the surface soil is usually a loam or a clay loam, the parent material being a calcareous boulder clay. There are some associated poorly drained areas in old drainage channels and lake beds but the proportion of swamp land is small. The Oxford land type is the basis of a prosperous agriculture, the fertility of its soil is attested by the general good appearance of the associated crops, livestock, and farm buildings. The typical Oxford landscape is one of the most pleasing in the whole province.

(3) *Guelph Land Type.*—The surface of this land type may be characterized as rolling upland interrupted by frequent swampy lowlands. Essentially a ground moraine area, but with its rather stony clay till moulded into several hundred oval or elliptical ridges known as drumlins; it also was traversed by the flood of water from the melting ice which cut fairly deep, well-marked valleys. The sides of these valleys often show deep gravel terraces while the floors of the valleys appear as long sinuous swampy tracts threaded by small sluggish streams or in many cases with no through-flowing water courses at the present time.

The uplands are well-drained since the ridges usually rise 50 to 100 feet above the adjoining swampy valleys. The soil is predominantly a greyish brown loam which is often quite stony but fertile and productive. About 75 per cent of this land type can be considered as available or potential crop land. The swampy valleys and their steep sides as well, have often been left in trees and should remain so, while there is a considerable area of sloping valley sides as well as some drumlin slopes which should always remain in grass if serious erosion is to be avoided.

FIGURE 7.—Land Types of the Grand River Valley.

(4) *Paris Land Type.*—Lying along the eastern margin of the region this land type is dominated by the strongly developed Galt and Paris recessional moraines. The surface is hilly with many depressions lacking external drainage—a typical knob and basin type of topography. The knobs and ridges usually stand 50 to 100 feet above the adjacent swamps of the valleys and enclosed depressions. Between the moraines there are extensive gravel trains and terraces deposited by Pleistocene drainage. The materials in the moraines consist of a rather open textured calcareous stony till pushed up along the ice front, together with a great deal of roughly stratified kame-like deposits. Apart from the depressions, the drainage of this land type is excellent—even inclined to be excessive, locally. A fairly deeply weathered grey-brown soil has

FIGURE 8.—Arthur till plain near Grand Valley.

developed which has been designated the Dumfries series. The surface texture is usually that of a stony loam or sandy loam.

Agriculturally, this land type possesses certain disadvantages. The openness of the soil makes it susceptible to drought while the many steep slopes predispose it toward soil erosion and stones interfere with cultivation. For these reasons and also on account of the large proportion of poorly drained lands the area of cultivated land is considerably restricted.

(5) *Waterloo Land Type.*—The central part of Waterloo County comprises a hilly upland which contrasts sharply with the gentler topography of the plains to the west. Its surface is extremely uneven, there are broad ridges with long slopes, sharp ridges, knobs, basins, sags, and swales. Small lakes are characteristic, the valleys and basins are swampy, as seepage keeps these areas constantly wet. Although coarsely stratified sand deposits seem to predominate, these are seen in many places to overlie a very uneven till sheet. The soils are, for the most part, light brown to yellow sandy loams and greyish-brown loams, medium to low in natural fertility. Both the topography and the nature of the soil material itself predispose these lands to accelerated erosion unless kept under trees or grass.

(6) *Burford Land Type.*—This land type comprises the sandy, and in some places gravelly, plains south of Paris. The area has a flat to gently undulating surface, interrupted by the southward continuations of the Paris and Galt morainic ridges. The lowest parts are very imperfectly drained and contain linear bodies of peat and muck land stretching in a north-south direction. These sandy plains are deltaic in origin having been deposited in the arms of glacial lakes by the precursors of the Grand River.

Apart from the muck areas, the surface soils are sands, sandy loams, and gravelly loams. Where drainage is free, the materials have weathered to a depth of two and one half to three feet, with the formation of a typical grey-brown forest soil profile. In the less well-drained portions there are variations of the half-bog type of profile, but when drainage is provided they become useful arable soils. The natural fertility of these sands is not high and they require artificial fertilizers in order to produce the special crops which tend to be produced on the light textured, well-drained, and therefore early lands.

(7) *Perth Land Type.*—The Perth land type occupies the northwestern portion of the Grand River drainage basin and is continued in a much larger area farther west. This flat to gently undulating area comprises a slightly lower portion of the till plains of west-

ern Ontario which was temporarily submerged at the time of deglaciation and it thus received a thin veneer of lacustrine clay. The drainage, in general, is somewhat impeded, the soil profile is incompletely developed and the surface is somewhat dark in colour. The natural fertility of these heavy soils is good and when drainage is provided, excellent yields of general farm crops may be obtained.

(*8*) *Zorra Land Type.*—The Zorra land type comprises a small area in which the surface features closely resemble those of the previously described land type The soils tend to be somewhat loamy in texture owing to the prevalence of sandy deposits along the streams.

(*9*) *Haldimand Land Type.*—This type occupies the southeastern and lowest portion of the Grand River Valley. The surface is usually gently undulating but on the borders of the water-laid moraines it may be quite rolling. It was submerged by the Pleistocene precursors of the present Lake Erie and received fairly deep deposits of silt and clay. Recent streams have cut sharp trenches but have not developed many tributaries so that the broad interfluves largely remain undulating or nearly flat. In places there are scattered low swells standing out of the general level to give a slightly rolling local relief. There is only a small proportion of marsh or swamp. The soils are greyish to light brown loams, clay loams, and clays which are usually somewhat acid in reaction. They are durable under cultivation and well adapted to the growth of forage crops. Except in the areas of heaviest clay, where the soil is a little too sticky, the agricultural value of the land is high.

(*10*) *Rockton Land Type.*—This type is found in a small area near the eastern margin of the basin. It is underlain by hard level-bedded dolomitic limestones having a very shallow drift cover and often exposed upon the surface. There is no conspicuous relief; the few low swells of glacial drift do not disturb the even skyline. The soils are shallow although usually composed of fairly fertile loam and on some farms produce good yields of crops. Shallow soils which are predisposed to drought together with rock outcrops and scattered stones which interfere with cultivation, tend to depreciate the value of this land for agricultural uses.

LAND UTILIZATION

Land utilization is not uniform throughout this region. It differs with the variation of climate from south to north and with different types of land, so that a survey of the agricultural use of land must be made according to land types. It was carried out by picking out one or two typical sample areas of about 1,000 acres in each of the ten land types. A comparison of these sample areas will show that agricultural use of land is influenced remarkably by the environmental factors—climate, soils, and topography.

(*1*) *Arthur Land Type.*—Owing to its extended area, it differs to some degree in land utilization between north and south. A typical sample block of land in the township of Garafraza West is

FIGURE 9.—Drumlin between Rockton and Guelph along Highway 1.

chosen as an example for the northern part. It is 1,030 acres in size, of which cropland accounts for 58.5 per cent including 1.5 per cent summer fallow. Pasture occupies 34.8 per cent and woodland and wasteland combine to constitute 6.5 per cent. In this sample area, the percentage of both the cropland and pasture are a little higher than the township average, and the woodland and wasteland area is slightly less. This may be accounted for by the fact that in the southern part of this township, the topography is rather more rolling. Also, in this part of the province, pasture land increases toward the north. This small increase seems to be normal.

There are several significant facts worth noting about the percentages of different crops to the total cropland. On this type of land, mixed hay is very important, occupying over 40 per cent of the area under crops. The figures for the near-by townships such as Arthur, Peel, and Maryborough are all more than 40 per cent. The percentage of the acreage in wheat is almost negligible, and most of it is spring wheat. It is planted around the 20th of April. Because of its higher elevation and more northern position, this area has a colder winter than any other area in the region. Spring comes later, so, the climatic factor is the chief reason for the small acreage of wheat. Another point is that this area grows little if any corn, because of shorter growing season.

A block was chosen near Linwood in the township of Wellesley as an example of the southern part. About 1,390 acres in size, it lies in an undulating country where clay loam predominates. The percentage of crop land including the summer fallow accounts for 77.6 per cent of the land. This figure is higher than the township average by six per cent, so that the woodland and wasteland become less. This may be explained by the presence of the rolling sand hills in the southern and central parts of this township, which, naturally, tends to increase the percentage of pasture land and woodland and thus to reduce that of the crop land. Also, the woodland area has been reduced considerably by cutting during the past ten years. In comparison with the figures either between the two townships or between the two sample areas, a remarkable contrast would be readily seen. The percentage of crop land in the south is 20 per cent higher, and that of the pasture land 15 per cent less than in the north. With the topography and soil much the same, such a striking contrast is largely due to the climatic factor enhanced by higher elevation, and the shallower depth of the soil in the north.

By examining the acreage of different crops, it is obvious that hay occupies a lower percentage by about 10 per cent, although it still holds an outstanding position. It is even more significant that wheat becomes much more important than it is in the northern part. Its percentage of the area under crops in the two sample areas is two per cent in the north and 10 per cent in the south. The average figure is 2.4 per cent in Garafraxa Township and 6.3 per cent in Wellesley Township. Also, the wheat grown here is winter wheat which is sown from the end of August to early September. Lastly, corn is almost negligible in the north

FIGURE 10.—Galt Moraine.

FIGURE 11.—Waterloo Sandy Hills southeast of Kitchener, near Roseville.

but it is quite commonly grown in the south, although the percentage of acreage is very small.

The whole area is a mixed farming country with beef cattle-raising as the chief activity. But dairying and hog-raising gradually take on importance toward the south, while the number of sheep decreases.

(*2*) *Oxford Land Type.*—A sample area of 950 acres has been chosen in the township of Wilmot which belongs partly to the till plain and partly to the Waterloo sand hills. The percentage of crop land in this sample area is 76 per cent, six per cent higher than the township average. This may be explained by the fact that the soils in the sandy hills are somewhat too light in texture. Moreover, the woodland area in this block is less. With reference to the sample in Wellesley Township, this area is much the same in land utilization, except that the percentage of area in woodland is somewhat larger than in the former.

There are some variations in the percentage of acreage under crops in comparison with the average figures of the township. In the sample area, the acreage of wheat occupies a larger percentage (11 per cent, two per cent higher), hay a little less (31 per cent, two per cent less), while mixed grains 27 per cent, five per cent higher) appear to be more important than oats (23 per cent, two per cent less). Because of lighter soil texture, wheat becomes more important here while hay acreage is smaller than in the southern part of the Arthur till plain.

This area is also a wealthy mixed farming country in which dairying and hog-raising are important. Many farms keep some beef cattle but the number is less in comparison with dairy cows.

(*3*) *Guelph Land Type.*—Because poor drainage in the interdrumlin areas and excessive drainage on the steeper slopes of some drumlins, this area is characterized by a high percentage of woodland and wasteland and a fairly large area of pasture land. According to the statistics of 1931, the township of Eramosa which lies in the heart of the drumlin belt has 21 per cent of its area left for pasture and 17 per cent for woodland and wasteland. In this township, a sample area of 1,570 acres was surveyed, of which 63 per cent is occupied by crop land, 19 per cent by pasture, and 17 per cent by woodland and wasteland.

Of the crops, hay and mixed grains are the most important. Both together constitute nearly two-thirds of the area under crops. Next in importance is oats. Wheat (nine per cent) holds an important place in this sample area in which its percentage is higher than the average of the township by more than six per cent. Possibly wheat has increased in favour during the past ten years. Another point worth emphasizing is that among the root crops, turnips are quite commonly grown in this type of land. Besides being used locally as feed, turnips are exported to the United States.

This area is mixed farming country, with beef cattle becoming more and more important toward the northeast. Dairy farms are usually smaller and, in most cases, are located near the main highways. The raising of hogs is also important. Sheep-raising is more com-

mon than in most of the other areas. On approaching an urban center, like Guelph, dairying and poultry raising become important, and the small truck gardens become common.

Because of the rolling surface and excessive drainage, this land type is apt to be subject to soil erosion, gulley and sheet erosion are not uncommon, especially on the steep slopes of the drumlins. The washing away of the finer material from the surface soil of the drumlins is particularly a matter of concern. So far as the writer has seen in the field, strip cropping is practiced only occasionally in some localities. There are many farmers still ignoring erosion by plowing the fields across contours. Steps must be taken for the conservation of soil resources.

(*4*) *Paris Land Type.*—A block of land with an area of 1,470 acres was surveyed by the writer in the township of Dumfries North, in which the acreage of crop land was 52 per cent, pasture 34 per cent and woodland and waste-land 13 per cent. Because this sample area lies mainly in the zone of the moraine where local relief of the land, in most cases, is 50 to 100 feet and in many places runs to 100 feet or more, the proportion of the area used for pasture is high. Furthermore, more than one third of the pasture land is unimproved, where many stones and large boulders are intermingled with the soil. It is better to leave the sloping land for pasture, so far as the conservation of soil is concerned.

FIGURE 12.—Flat Haldimand lake plain type of land near Ohsweken.

FIGURE 13.—Pasture and woodlots are principal features of Farmington loam area, southeast of Sheffield.

Field crops occupy 50 per cent of the area of the block surveyed, which is three per cent lower than the average. Of these, hay (28 per cent) is the most important crop. Next is oats (26 per cent) and wheat holds the third place, taking 22 per cent. Others are mixed grains, barley, potatoes, corn, and so on. It should be pointed out that the acreage of wheat is quite high in the moraine area, and in this block it is about six per cent higher than the average figure in Dumfries, North Township. The chief reason for this seems to be the lighter texture of the soil and good surface drainage. Other crops are potatoes, corn, and soy beans which account for three, two, and one per cent respectively.

In the moraine area, mixed farming is dominant; but near cities and towns, dairying becomes more important. Along main highways, more dairy farms are found. Except in local areas, the raising of beef cattle is more important than other industries throughout this region.

FIGURE 14.—Strip-cropping west of Guelph.

On the slopes of the morainal hills, crops are also grown. In some instances, the sloping land is plowed across the contours. Such practice will cause a great deal of soil erosion.

(5) *Waterloo Land Type.*—Despite its rolling topography, this area is highly cultivated. Except for a very few small areas to the west of the town of Waterloo where the surface is exceptionally hilly, there is practically no waste or unimproved land in this land type.

A sample area of 1,126 acres in the township of Waterloo South was surveyed. The percentage of the crop land area is 75 per cent, eight per cent higher, and that of the woodland is 11 per cent, four per cent less than the average of the township. Except in those small and exceptionally hilly areas, the general picture of the land utilization of this type of land agrees pretty well with that of this sample area.

The acreage of hay (28 per cent) is slightly larger than that of oats (26 per cent) or mixed grains (24 per cent). It is interesting to note that the percentage of the area in rye is remarkably higher in this area than in most other land types, although its actual acreage is very small. This is largely due to the light texture of the sandy soil which covers most of the area, for in some areas to the west of the town of Waterloo where the Guelph loam soil predominates over the Waterloo sandy loam, little, if any, rye is grown.

This is a typical mixed farming country. On account of its proximity to Kitchener, Waterloo, and Preston, it is important in dairying, raising hogs and poultry. Grains also form a part of the farmers' income.

(6) *Burford Land Type.*—As already noted the Burford land type comprises a sandy plain with varied drainage conditions. Agriculture, naturally, is more highly developed in the areas of better drainage. A sample area of 926 acres, representative of this condition was studied near Mount Vernon in Burford Township. In it, crop land accounted for 83 per cent of the area, pasture 14 per cent, woodland and wasteland two per cent, the latter confined entirely to the road allowance. Tobacco and rye combined, occupy nearly 60 per cent of the area under crops, while hay and oats, the major crops in other land type areas, involve less than 25 per cent. Corn becomes nearly as important as hay or oats with 11 per cent.

In comparison with the 1931 census figures for Burford Township, it is notable that the sample area contains much more crop land and less pasture and is perhaps not to be regarded as entirely typical. On the other hand, the area has undergone a great expansion in the tobacco industry and these figures serve to emphasize its importance on this land type.

The area as a whole is a mixed farming country with emphasis on dairying, but on the well-drained sands and sandy

FIGURE 15.—Well-to-do dairy farm near principal highway southeast of Galt.

loams, tobacco culture is most important. The natural fertility of these soils is low, but that is of no importance for the tobacco grower employs artificial fertilizers to meet the requirements of his crop. The essential factors are good drainage, water holding capacity, and workability, and in these respects, these soils are ideal for tobacco culture. The preferred types are classified in the Fox series, of which the following is a simplified profile description: (1) A^1, light brown sand or sandy loam; (2) A^2, yellow sand or sandy loam; (3) B, reddish brown loam; (4) C, stratified grey sand or gravel. The first horizon can warm up early in the spring, the second holds humus and fertilizer, the third provides for water holding, and the fourth insures good internal drainage.

The southerly position of this area and its proximity to Lake Erie provide a longer frost-free season, averaging 140 days, especially in delaying the early September frosts until the grower is enabled to complete his harvest.

The tobacco farms are well scattered all over this area. A typical tobacco farm has an area of about 100 acres and is provided with the usual barns and outbuildings of the Ontario general farm which it was before the tobacco era. The newer elements include a glass starting house for the young tobacco plants, an elevated water tank, and a battery of about half a dozen curing barns. The tobacco crop occupies about 30 acres, rye about 25 acres, corn and oats another 20 acres, and pasture about 20 acres. The rest is included in the farmstead, farm lanes, etc.

Rye is usually grown before tobacco in order to add organic matter to the soil and to aid in keeping insects under control. Corn is usually grown after tobacco. Thus a large part of the farm is operated on a definite rye-tobacco-corn rotation. In some years rye is replaced by oats. The corn crop may include canning corn, table corn for the autumn market, husking corn, and silage corn.

(7) *Perth Land Type.*—This type of land lies mainly in Perth County, and partly in Waterloo County. A sample area of 1,160 acres was surveyed in the township of Wellesley, Waterloo County. In this sample area, 73 per cent of the land is in crops, 21 per cent in pasture, six per cent in woodland. In comparison with the township of Mornington where the physical background is much the same, the general character of land utilization in the surveyed block is near the average condition, save that the percentage for pasture is a little lower. It is worth noting here that in this land type the area devoted to pasture is fairly large. This may be due to the heavier-textured soil, although it is more or less granular in structure.

In this sample area, the percentage of the area under crops is eight per cent higher than average. Such an increase

FIGURE 16.—Plowing of fields up and down the slopes induces sheet and gulley erosion above, and deposition below.

FIGURE 17.—Tobacco barns and young tobacco plants in field near Mt. Pleasant. (Photo D. F. Putnam.)

together with the decrease of the pasture land (four per cent lower than average) may be largely due to human factor, the occupants of the land. The township of Mornington is inhabited mainly by the Scotch and Irish people whereas Wellesley is settled by the Dutch who are regarded as more energetic farmers.

Of the area under crops, both of the whole township and the sample area, the acreage of wheat (five per cent) and corn (less than two per cent) is fairly low; while that of hay is very large (over 40 per cent), larger than in most other areas. Also, the acreage of potatoes and root crops constitute only 1.5 per cent of the total area of the township while only one acre of rye was recorded in 1931 in the township statistics. Poor drainage and the heavy texture of the soils are the chief factors concerned.

The raising of hogs and dairying are the major agricultural activities. Since the war started, farmers have begun to take an interest in raising beef cattle which are few in normal times.

(*8*) *Zorra Land Type.*—A sample area with 1,126 acres was surveyed in the township of Zorra East in Oxford County. It is remarkable that the percentage of the area under crops reaches as high as 81 per cent, which is much higher than the average figure of the township (66 per cent), while that of the pasture land (13 per cent) is much lower than the average (25 per cent). This may be accounted for by the fact that the southern half of the township is a rolling country where the percentage of pasture land would become greater and thus reduce that of the crop land. When one travels in this part of the country, one is quite impressed by the area of land devoted to the growing of crops, and with the few small woodlots scattered about. Because the area is favored by topography and soil, it forms one of the most highly cultivated districts in the southwestern peninsula of Ontario.

So far as the crop land area is concerned, hay (28 per cent) is the most important, then come the mixed grains, oats, wheat, barley, corn, and others. In comparison with the average figures of the township, it is striking to note that the acreage of wheat (15 per cent) is nearly double the average. This is because of the soil factor, for the presence of sandy material in the clay loam creates a more favorable environment. Also, it is worth noting that the acreage of corn amounts to five per cent.

This is a mixed farming area with dairying and the raising of hogs as the principal activities. Oxford County has long been acknowledged as one of the leading dairy counties in the Dominion

FIGURE 18.—Interior of tobacco starting house. (Photo L. J. Chapman.)

of Canada; this is reflected in the cropping system by the amount of land devoted to the growing of hay and silage corn. The grain crops, which also cover a large acreage, serve in part to feed the dairy cows, and also to feed large numbers of bacon hogs which in some parts of the area are of equal or greater importance.

(9) *Haldimand Land Type.*—This type of land lies in the southeastern part of the region. The area is settled by two different cultural groups, the white people and the Indians. Two sample blocks were surveyed with a view to comparing the land utilization between these two sub-areas. One sample area of 1,216 acres was surveyed in the Indians' township of Tuscarora, Brant County, where the sticky Haldimand clay predominates. It is striking that the area under crops (44 per cent) is less than half of the total, that of the pasture land is more than one-third, and that of woodland and wasteland amounts to one-fifth of it. The proportion of land area under these three different types of cover agrees quite well with the general condition. Of the area under crops, either in the whole township or in the sample area, hay constitutes over 40 per cent, oats over 25 per cent, while mixed grains, barley and wheat, each occupies less than 10 per cent. In addition to the low percentage of land in crops, the crops themselves are invariably poor. This is partly due to the hardness and stickiness of the clay land; but there is another factor accounting for it, i.e. most of the Indians are not energetic farmers. The land is by no means properly managed.

Another sample area of 1,006 acres in size was surveyed in Onondaga Township, settled by the whites, in which the soils for the most part are clay loam except in the areas bordering streams where loam predominates. The area in crops both in the whole township and the sample area is over 70 per cent, and that of pasture land is less than 20 per cent. Of the latter, only very small areas are classified as unimproved pasture land. In comparison with the figures (Table 2) of the previous sub-area, this is much more highly cultivated. Of course, the soils in this sub-area are bettered-textured, but the occupants of the land play an important part in bringing about such a contrast in the degree of intensity of land utilization.

TABLE II

LAND UTILIZATION ON THE HALDIMAND LAND TYPE

	INDIANS		*WHITES*	
	Tus. Tp.	*Sample Area*	*Onon. Tp.*	*Sample Area*
Area (in acres).....	32,644	1,216	20,887	1,006
Crop land and fallow per cent of total...	43.3%	44.0%	70.4%	76.0%
Pasture land per cent of total.....	34.2%*	33.5%	17.2%*	17.4%
Woodland and waste land per cent of total.....	15.4%	20.8%	7.7%	6.0%

*14.2% improved. 20.0% unimproved.

13.1% improved. 4.1% unimproved.

Of the area under crops, hay and oats are the leading crops with 66 per

FIGURE 19.—Young tobacco plants in field near Mt. Vernon.

FIGURE 20.—Typical white's farmstead, near Onondaga.

FIGURE 21.—Typical Indian farmstead southeast of Onondaga.

cent; mixed grains account for about 15 per cent, wheat and barley for 13 to 14 per cent. It should be pointed out that, in addition to grains, the acreage of peas is six per cent, and soy beans two per cent. The growing conditions of these crops also present a great contrast to those in Tuscarora Township. In most of the other land type areas, hay is a rather mixed crop, but here it grows separately, in most cases, according to the individual kinds.

This sub-area is a typical and prosperous mixed farming area. It is important in dairying, and the raising of beef cattle, hogs, and poultry. On the average, 60 to 80 per cent of the grain is used as feed on the farms and the rest is sold for seed. The growing of hay such as alfalfa and clover which are often regarded as cash crops is also partly for seed. In the preceding subarea, the chief interest lies in dairying, raising hogs, and poultry, but it is a poor farming country. Also, it is a land of small farms, mostly less than 50 acres.

Along the slopes of the stream valleys in this land type, considerable gulley erosion may be noted. It would appear that the uniform texture of these soil materials renders them very susceptible to erosion and that some organized effort should be made to check further soil loss.

(*10*) *Rockton Land Type.*—Because of shallow soil or poor drainage, the area of cropland in this sub-region is very small, and so the land utilization is restricted mainly to pasture. A sample area of 1,180 acres surveyed northwest of Rockton, in the township of Beverly, Wentworth County, a large part of which lies in this type of land shows the area left for pasture including the unimproved pasture amounts to about 60 per cent of the land, over 30 per cent more than the average, while that of the crop land is estimated at only 20 per cent.

The crops grown are hay, oats, wheat, barley, corn, potatoes, and others. The last two named crops are negligible. Hay and oats are the most important crops, accounting for 31 and 33 per cent respectively. Because of the shallowness of the soil, crops are often not in good condition. For instance, during the late spring or early summer rains, ponds are apt to be found in many fields.

The agricultural practice in this area is mixed farming with dairying and beef cattle raising. Some farmers keep sheep. Hogs are not very common. Farms are usually larger than in most other types of land. The agricultural value of this area is low. Most of the farms are not well-off; abandoned farms are common.

FIGURE 22.—Gulley erosion southwest of Onondaga.

GENERAL CHARACTERISTICS OF THE AGRICULTURE

The dominant characteristic of agriculture of this region is a diversified livestock combination—dairy cows, beef cattle, hogs, sheep, poultry, foxes, minks, etc. It is a region of intensive livestock production. Dairying, beef cattle, and hog-raising are the most important and prevailing types of farming. The livestock units per square mile of farm land vary from 100 to 180, but on the average are around 160.

The high percentage of both the improved land and the crop land is another outstanding characteristic of the agriculture. In 1931, there were in the three counties, Brant, Waterloo, and Wellington, 11,458 farms comprising 1,164,322 acres or 93 per cent of the total area. Seventy-nine per cent of the farm land was improved. Of this 1,164,322 acres, 62 per cent was crop land, 23 per cent pasture, and 13 per cent woodland and wasteland.

The average farm includes approximately 100 acres but there is considerable variation and, if fruits and truck farm were excluded from the calculation the average of the general farms would probably be about 110 acres. The average farm was slightly larger in the north than in the south.

The fourth characteristic of the agriculture is the high proportion of productive land and the diversification of crops. Crop yields are high. With the lack of a large area of rock surface, extensive swamps or other physical drawbacks, the climatic and soil conditions have permitted a wide choice of crops to be grown in this region in response to demands except only in the northern upland area where killing frost is a great threat. A list of farm products, excluding those of the livestock, includes wheat, barley, rye, oats, corn, buckwheat, hay, potatoes, turnips, mangels, peas, soy beans, tobacco, vegetables, small fruits, and others.

The last outstanding characteristic of agriculture is the domination of forage crops in the cultivated land. As noted before, diversification has always been the conspicuous feature of agriculture. Nevertheless, in spite of the diversity, a closer examination of the agricultural statistics reveals that 78 per cent of the entire area under crops in these three counties is monopolized by three crops, namely: oats, mixed grains (largely of oats and barley), and hay. The domination of these three, together with other forage crops, is closely related to commercial livestock production. It is, therefore, proper to say that, despite

FIGURE 23.—Unimproved pasture land, common in rocky plain near Sheffield.

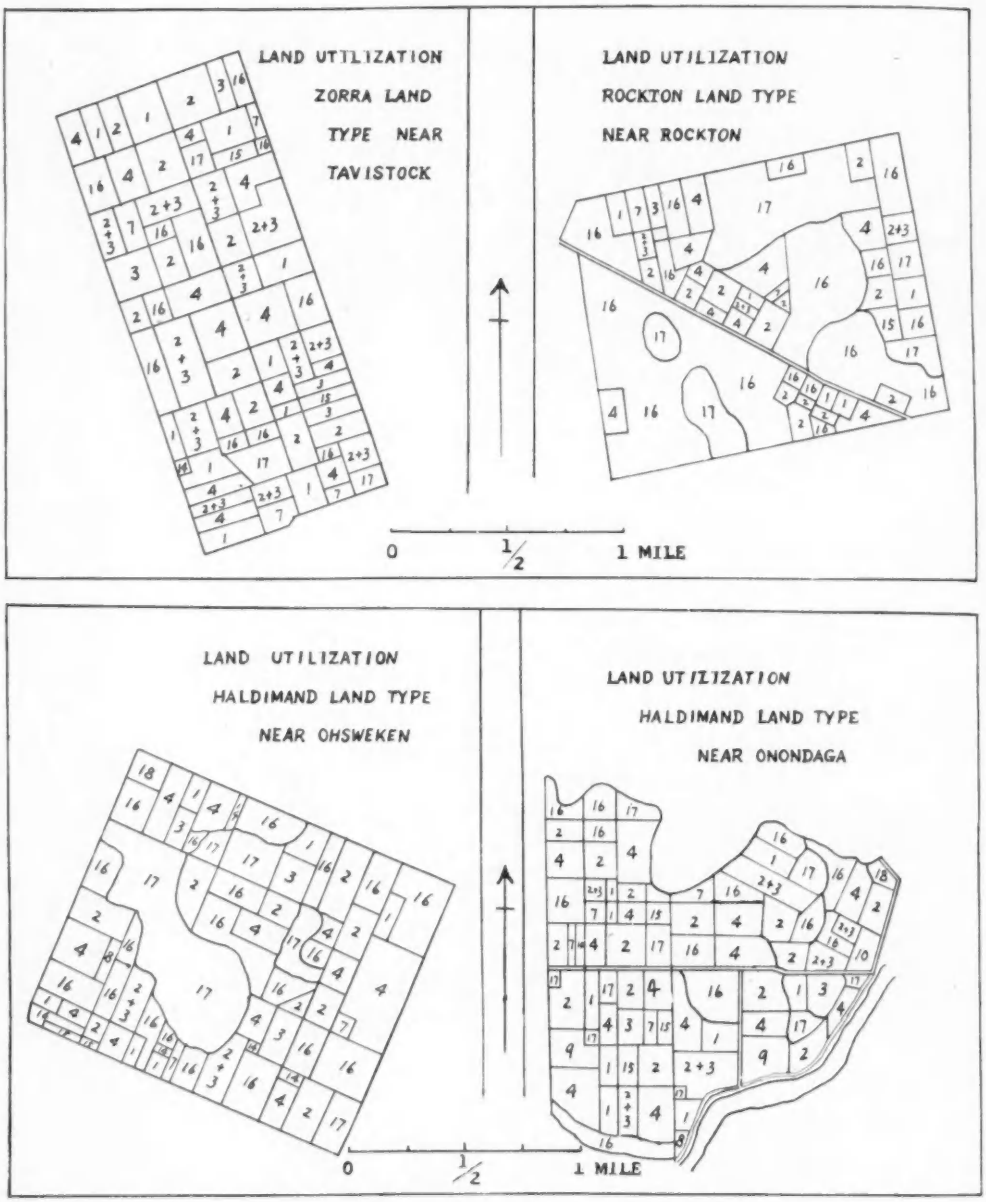

FIGURE 24.—Land Utilization maps.

LEGEND—1 wheat, 2 oats, 3 barley, 2 + 3 oats and barley, 4 hay, 5 tobacco, 6 rye, 7 corn, 8 potatoes, 9 peas, 10 soy beans, 11 turnips, 12 mangels, 13 buckwheat, 14 other crops, 15 summer fallow, 16 pasture, 17 woodland and wasteland, 18 urban.

local variation, the signal fact in the agriculture of this region is the commercial output of livestock products.

CONCLUSION

There is a great variety of agriculture crops and farm types in this region, due

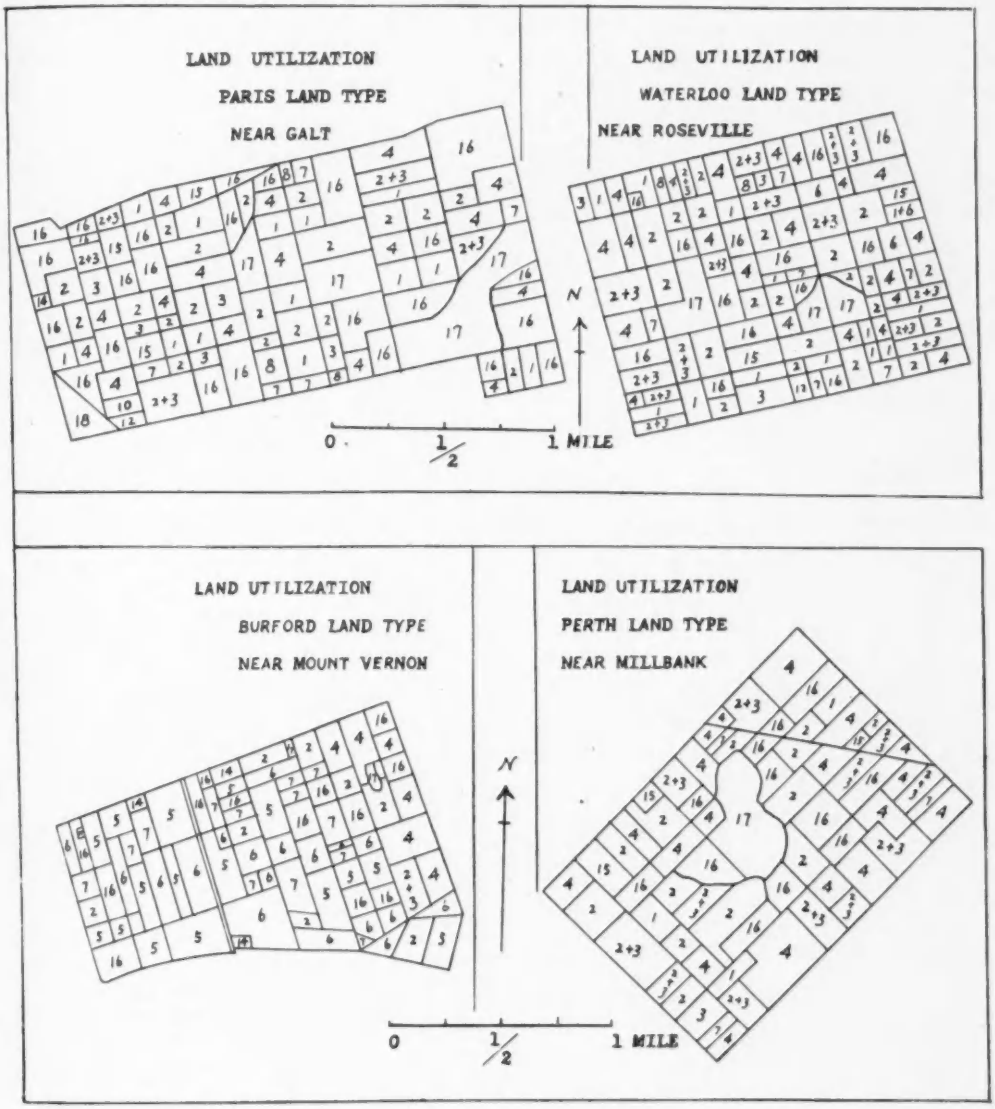

FIGURE 25.—Land Utilization maps.

to varying soil textures, climatic variations, nearness to urban centers, as well as different cultural groups of the occupants. The growing of tobacco on the Burford sandy plain in the south is due to the light-textured soils and the southerly location of the area. The distribution of rye is distinctly associated with the belts of sandy soil. Cold winters restrict fall sown wheat to the south. Also, there is little corn grown in the north largely because of a shorter growing season. On the other hand, a considerable portion of the corn grown in the Burford sandy plain is for canning purposes. Near the urban centers different kinds of vegetables are grown. Notwithstanding such variety, the region cannot be divided into sub-regions simply according to agricultural crops. Hay, oats, and the mixed grains are widespread and form the major crops.

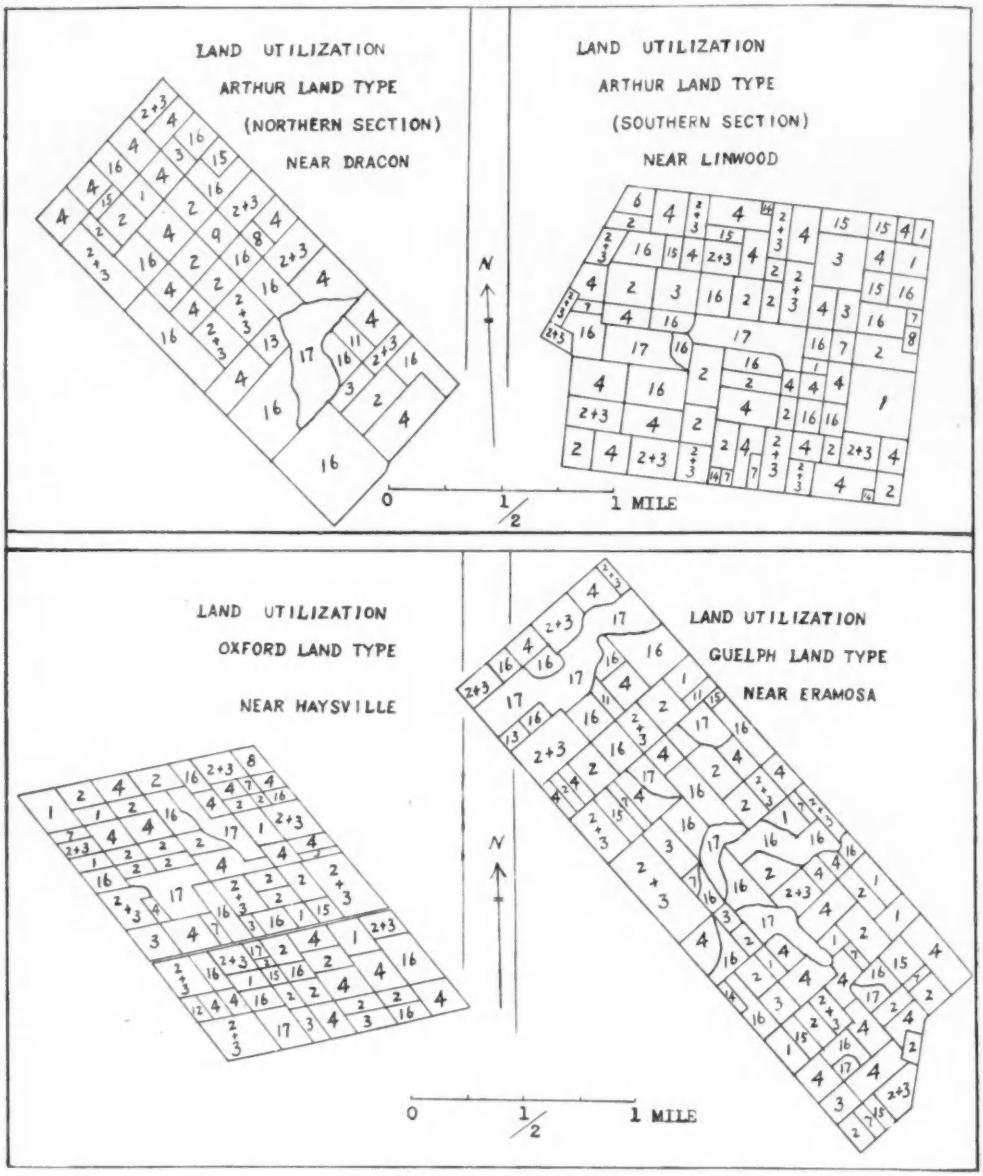

FIGURE 26.—Land Utilization maps.

Their combined acreage usually constitutes more than two thirds of the cropland in almost all the townships and the surveyed sample areas.

As to the types of farming, O. E. Baker in his classification of the agricultural regions of North America has included this region in the Hay and Dairy Belt. R. Hartshorne and S. Dicken defined it as Hay-Pasture-Livestock Region, but with meat specialty in the north and dairy specialty in the south. D. S. Whittlesey delimited its northern portion as part of the Commercial Livestock and Crop Farming and its southern part in the Commercial Dairy Region. The boundary in the last two classifications runs in this region roughly

FIGURE 27.—An abandoned farmstead on stony land.

parallel to the northern line of Brantford Township and across the township of Blenheim, Oxford County. J. R. Whitaker has defined the central and southern parts of this region, south of the line corresponding to the northern line of Wilmot Township and of Waterloo Township and that of Beverly Township, as the principal dairy area. In this area, the density of cows in milk or calf is over 40 head per square mile; the number of dairy cows over 30 head in every 100 livestock units; the production of milk per acre of all land is more than 30 gallons; that per acre of crop land over 50 gallons.

Based upon the field study by the writer, there are clearly two dominant types of farming; in the north beef cattle-raising, in the south dairying. But in most of the central part, hog-raising is nearly as important as dairying. For a detailed examination, they may best be discussed in relation to land types, the raising of beef cattle predominates in the Arthur till plain and the Guelph drumlin belt. The Oxford till plain, the Waterloo sandy hills, the Perth lake plain, and the Zorra lake plain are characterized by dairying and the raising of hogs. The Paris-Galt moraines northeast of Galt, and the Rockton rocky plain are a typical mixed farming district with somewhat greater importance in raising beef cattle. But along the highways, dairying is more important. The raising of hogs, sheep, and poultry come next. In the Haldimand lake plain, dairying is of primary importance, while the raising of beef cattle, hogs, poultry, and the cultivation of seed crops come next. The Burford sandy plain is characterized by the growing of tobacco, but dairying is important as well. In those areas within which lie the urban centers there are market gardens in the vicinity of the cities or towns.

BOOK REVIEWS

MALIN, JAMES C. *Winter Wheat in the Golden Belt of Kansas.* University of Kansas Press, Lawrence, Kansas. Price $3.00.

Professor Malin is the author of four other important historical volumes in the last quarter century, including:

Indian Policy and Westward Expansion. Humanistic Studies, Volume II, No. 3, Lawrence: University of Kansas. 1921;

An Interpretation of Recent American History. New York: D. Appleton-Century Company. 1926;

The United States after the World War. Boston: Ginn and Company. 1930;

John Brown and the Legend of Fifty-Six. Philadelphia: The American Philosophical Society. 1942.

Like those four books "Winter Wheat in the Golden Belt of Kansas" constitutes an example of successful application of geographic facts and principles to the interpretation of American history. It is a more successful use of geographic criteria for explaining and elaborating history than any of the preceding volumes has been, though all of them have engaged the geographic discipline to a greater or lesser degree. Few historians have succeeded better than Professor Malin in such application of geography to historical interpretation.

That Professor Malin recognizes the value of geographic material in the study of such a subject as forms the major content of this book is indicated by the sub-title which he has given it "A Study in Adaptation to Sub-humid Geographical Environment." Throughout the book the author deals extensively with geographic elements such as relief, drainage, precipitation, temperature, seasonality, soils, insect pests, and the various factors of human geography as well. Because Professor Malin so deliberately uses such geographic criteria in his historical interpretation of the agricultural development of the wheat belt of Kansas, his technique is of particular interest to geographers as well as to historians and farmers. His book represents a happy and successful combination of agronomy and farm economy upon a geographical and historical basis. It is the considered opinion of the reviewer that Professor Malin's studies point the way toward a most fruitful field of writing and research, a field in which geographers should feel as much at home as agronomists, economists, and historians. It represents a borderland of several sciences in which each of the several disciplines may make a distinct and definite contribution.

"Winter Wheat" presents in an interesting and authoritative way some of the outstanding characteristics of a section and a period that play an important role in the economic and political history of our country. Because of its limited field, both in time and area it includes a great deal of detail that cannot, for want of space and time, be incorporated into histories or geographies that cover a longer period or a wider expanse. In this respect "Winter Wheat" is sure to become a source book for research workers in both history and geography and in economics and agriculture as well.

Because it opens up such a promising field for the geographer, "Winter Wheat" is one of the books that our geographers should add to their shelves, particularly the younger group who are casting about for a productive and interesting field of research for the postwar period, when the administrative departments of our government, and the several branches of the armed services no longer require their time and efforts in the critical needs of the war emergency. The field which "Winter Wheat" opens is such a broad one, and offers so many opportunities for valuable research, that its potentialities are not likely to be exhausted for decades to come.

W. E. E.

LANDIS, PAUL H. *Population Problems.* American Book Company. Price $3.75.

The field of demography is not so new and unoccupied a territory for research and investigation as is the field opened up by Professor James C. Malin in "Winter Wheat," but that the field offers attractive problems for study and solution is strikingly borne out by "Population Problems," which contains so much that is new and interesting and valuable for folk in general, and considerable that is distinctly geographic in its significance. Both directly and indirectly geographical facts and principles are utilized throughout this important book, involving the several fields of physical geography as well as human geography. The relation of fecundity and reproduction, of birth rate and mortality, of sex composition and ethnic composition, and many other phases of demography to the attributes of place which are the distinctive criteria of geography are manifold and complex, necessitating a great deal of research into geographical factors, and appreciation of the significance of geographical relationships. The field of demography may well engage the attention of competent and able geographers. with benefit to the field. Professor Landis in this book "Population Problems" shows effectively how important geographical factors really are.

The book, as the preface states "aims to present a treatment of population which will meet at least four standards: (1) proper emphasis on social and cultural factors as forces in the biological behaviour of man; (2) primary stress upon social implications of population data and their human significance rather than on a statistical presentation of biosocial facts;

(3) classification of population into categories that have sociological meaning, and analysis of data within these categories; (4) proper presentation of population movements as a function of changing culture patterns."

As Gunnar Myrdal, Swedish population authority, stated in the Godkin lectures at Harvard University in 1938: "Democracy, not only as a political form but with all its content of civic ideals and human life, must either solve this problem or perish. To my mind no other factor—not even that of peace or war—is so tremendously fatal for the long-time destinies of democracies as the factor of population." On such a premise as this a geographer may build a program of research that he can justify by its value as well as its interests. Professor Landis, by his very comprehensive and authoritative book, proves how scholarly such research may be and how valuable it is.

W. E. E.

SMITH, GUY-HAROLD and GOOD, DOROTHY with the collaboration of SHANNON MCCUNE *Japan, A Geographical View*. American Geographical Society, Special Publication No. 28. Price $1.50.

The American Geographical Society has contributed to the literature of American geography a multitude of books and pamphlets that have had value far beyond even the most appreciative person's estimate. This book on Japan by the three authors listed, is another such outstanding contribution, valuable far in excess of the price asked for it, or any publicity that it can receive. There have been many good books upon Japan but this relatively modest volume contains a wealth of material scrupulously and critically compacted within small space. Though it cannot fairly be said that it is as valuable as some of the publications which have come from the Society, for its size and field it compares most favorably with the best. When the war is once over a much larger part of our population will be deeply interested in Japan and Japan's activities, and every such book as this will have greater value than it has in the period of its publication. It is written strictly from the geographer's point of view, and consequently by far the larger part of the material is concerned strictly with matters of interest to the geographer though of course with value to the general reader. For a picture of Japan as it is at this time this book provides the major lines and masses of information.

Though it is not bound in the gray cloth which has distinguished the Society's publications in the past and served so well to mark them out on the book shelves of the libraries of this and other countries, and therefore is not so attractive, it still retains the form, and somewhat the appearance of the former volumes. It is printed on the kind of paper and in the font of type which for so many years has lent dignity and facility of reading to the *Geographical Review* and so many others of the Society's publications. Probably every geographer of professional training in the United States will turn to this book as the final authoritative work on Japan.

W. E. E.

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The Cotton Belt of North Carolina, Franklin C. Erickson, University of North Carolina.
Czech Farmers in Oklahoma, Russell W. Lynch, U.S.N.R.
The New Bright Tobacco Belt of North Carolina, P. W. Picklesimer, East Carolina Teachers College, Greenville, North Carolina.
The Bulb Industry of Western Washington, J. P. Galvin, U.S.N.R.
Freight Rates as a Geographic Factor in Illinois, John W. Alexander, U.S.N.R.
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Worcester, Mass., U. S. A.